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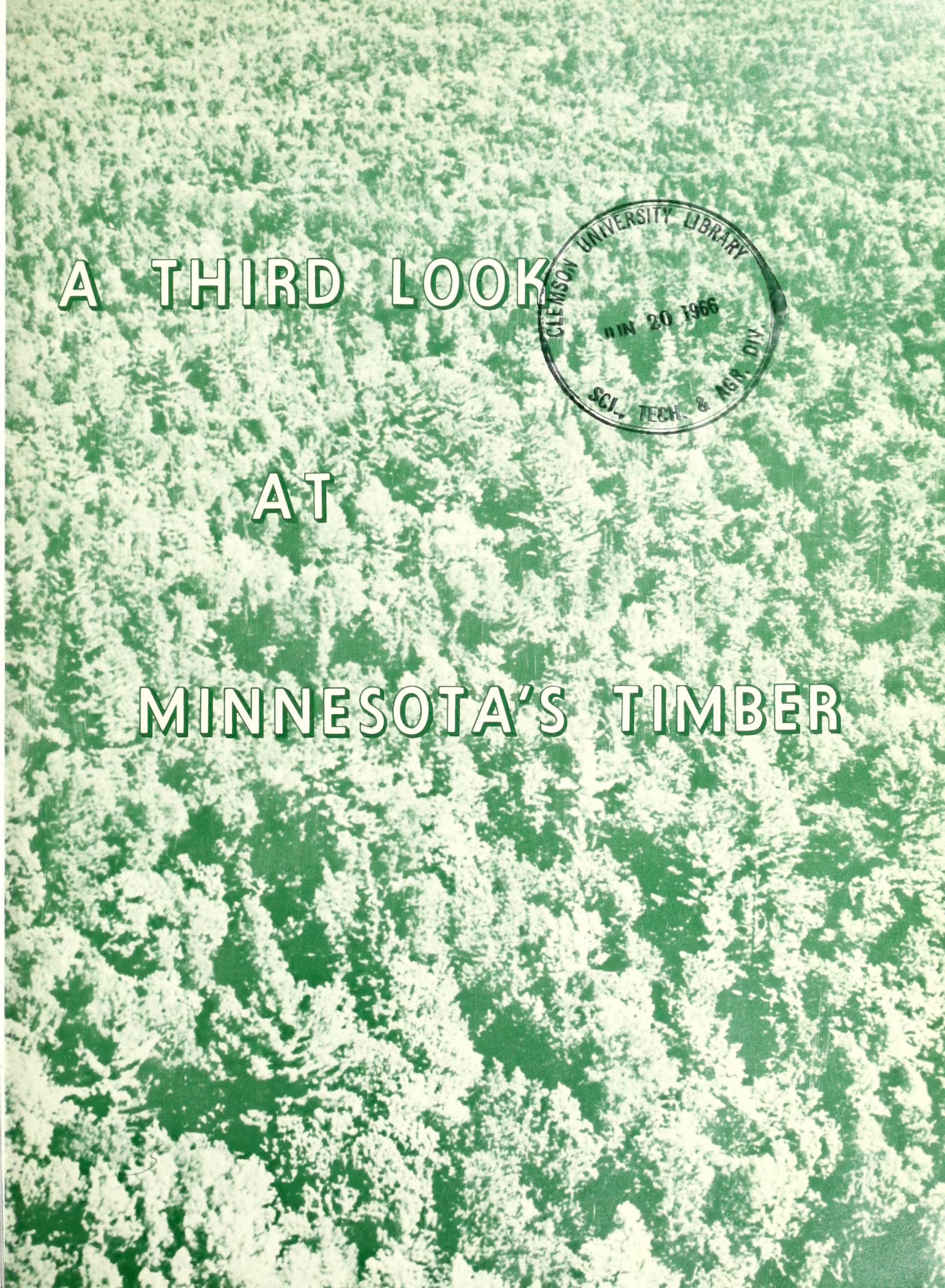

A THIRD LOOK AT MINNESOTA'S TIMBER

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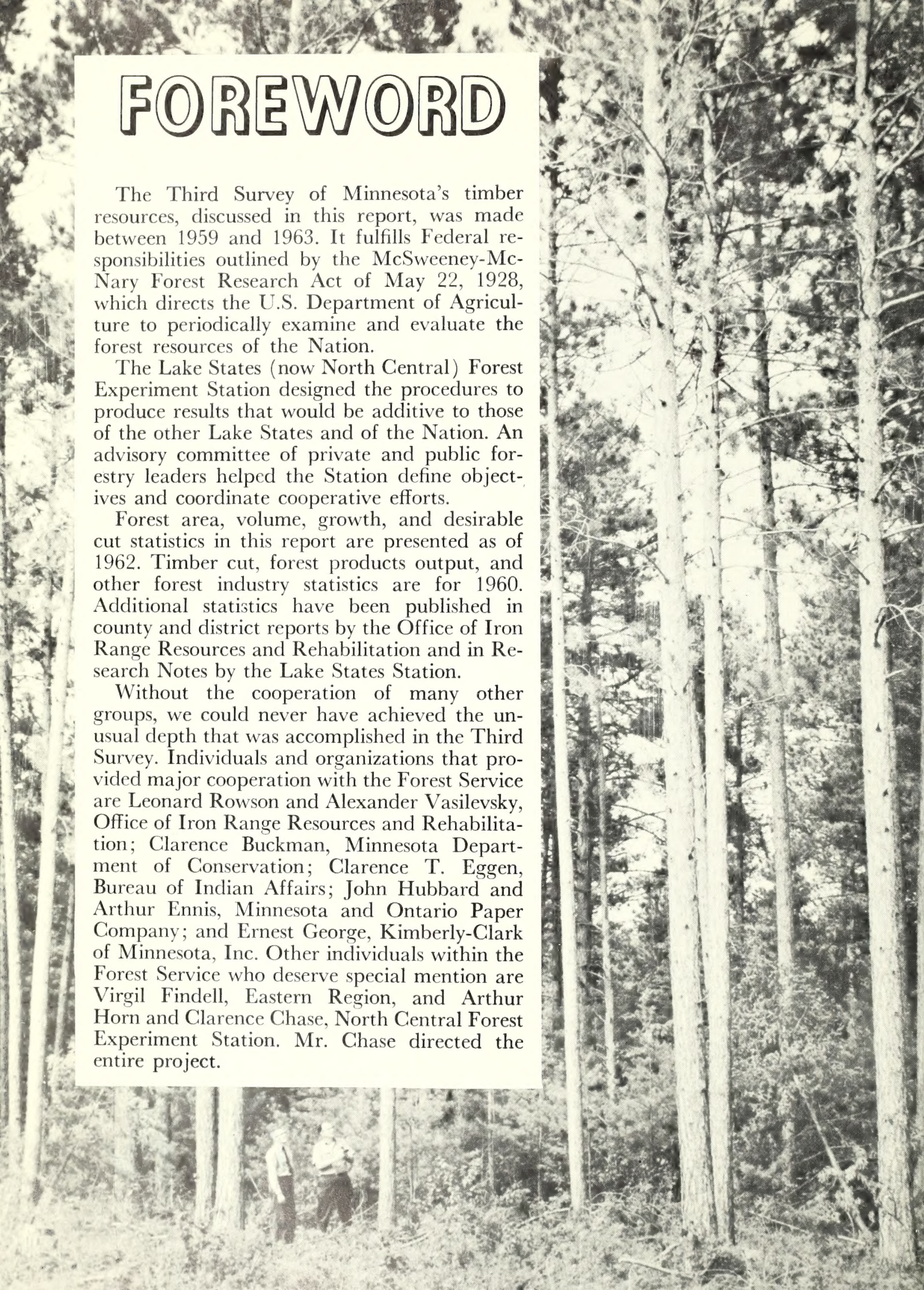
FOREWORD

The Third Survey of Minnesota's timber resources, discussed in this report, was made between 1959 and 1963. It fulfills Federal responsibilities outlined by the McSweeney-McNary Forest Research Act of May 22, 1928, which directs the U.S. Department of Agriculture to periodically examine and evaluate the forest resources of the Nation.

The Lake States (now North Central) Forest Experiment Station designed the procedures to produce results that would be additive to those of the other Lake States and of the Nation. An advisory committee of private and public forestry leaders helped the Station define objectives and coordinate cooperative efforts.

Forest area, volume, growth, and desirable cut statistics in this report are presented as of 1962. Timber cut, forest products output, and other forest industry statistics are for 1960. Additional statistics have been published in county and district reports by the Office of Iron Range Resources and Rehabilitation and in Research Notes by the Lake States Station.

Without the cooperation of many other groups, we could never have achieved the unusual depth that was accomplished in the Third Survey. Individuals and organizations that provided major cooperation with the Forest Service are Leonard Rowson and Alexander Vasilevsky, Office of Iron Range Resources and Rehabilitation; Clarence Buckman, Minnesota Department of Conservation; Clarence T. Eggen, Bureau of Indian Affairs; John Hubbard and Arthur Ennis, Minnesota and Ontario Paper Company; and Ernest George, Kimberly-Clark of Minnesota, Inc. Other individuals within the Forest Service who deserve special mention are Virgil Findell, Eastern Region, and Arthur Horn and Clarence Chase, North Central Forest Experiment Station. Mr. Chase directed the entire project.



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A THIRD LOOK AT MINNESOTA'S TIMBER

by

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Published by

NORTH CENTRAL FOREST EXPERIMENT STATION[2]

D. B. King, Director

FOREST SERVICE — U. S. DEPARTMENT OF AGRICULTURE

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TREND HIGHLIGHTS

Recently, Minnesota's timber volume has expanded considerably. Between 1936 and 1953 it increased only 10 million cords. Since 1953 another 34 million cords have been added, including increases of 28 percent for softwoods (reversing a downward trend) and 41 percent for hardwoods.

Timber quality trends, however, reflect smaller trees than before. Compared with 1953, the State has 13 percent more hardwoods and 2 percent more softwoods under 11 inches d.b.h. This has lowered the average saw log quality. In 1953 about 33 percent of the hardwood sawtimber volume was in No. 1 and No. 2 grade logs; by 1962 the figure was only 22 percent.

Forest land has diminished about 3 percent since 1936, but present farmland retirements and reforestation activities may reverse this trend. Public agencies still control about 56 percent of the commercial forest land — the same as was noted in 1953 and more than any other State east of the Rocky Mountains. Minnesota also has more county-owned commercial forest land than any other State and is second only to Michigan in State Forest acreage. Compared with the other Lake States, relatively little of Minnesota's forest land is owned by industry.

Tree planting has increased sharply. More trees — principally red pine — were planted from 1955 through 1964 than in all former years combined. More than half of the 3.6 million acres that were nonstocked in 1953 have been restocked either by natural regeneration or by reforestation. Growing stock volume is up, too, from 5.0 cords per acre in 1953 to 7.3 cords at present. Also, sawtimber and poletimber acreages have increased substantially.

These statistics lead to the conclusion that the annual desirable cut is on the increase. In fact, the calculated desirable cut of total growing stock has doubled to 4 million cords since 1936. The hardwood sawtimber desirable cut has doubled, also, but that of softwood sawtimber has increased only 5 percent.

The harvest has not kept pace. Timber cut has declined from 1.9 million cords in 1953 to 1.6 million cords in 1960 (evenly divided between hardwoods and softwoods). Yet the total cut in 1960 exceeded that of 1936 by 14 percent, and that of aspen nearly doubled. The pulpwood portion of the total cut increased from 27 to 60 percent since 1936, while the fuelwood portion dropped from one-third to just one-eighth of the product volume.

The details of these trends are discussed in the sections that follow. Statistics are presented in tables 1 through 50 in the Appendix.

	1936 Survey	1953 Survey	1962 Survey
Forest type areas:		*Million Acres*	
Pine	1.6	1.3	1.3
Spruce-fir	1.1	1.2	1.2
Conifer swamp	2.5	2.0	2.4
Upland hardwood	1.9	2.0	2.1
Lowland hardwood	.6	1.1	2.0
Aspen-grass-brush	10.4	9.7	8.1
Nonproductive and other[1]	1.5	2.0	2.0
Total	19.6	19.3	19.1
Stand-size area:		*Thousand Acres*	
Sawtimber stands:			
Softwood types	644	548	631
Hardwood types	876	1,469	1,756
Poletimber stands:			
Softwood types	2,077	1,855	2,434
Hardwood types	2,340	3,426	6,086
Total	5,937	7,298	10,907
Sapling and seedling stands:			
Medium- and well-stocked	4,106	4,646	3,383
Poorly stocked	4,289	1,671	911
Total	8,395	6,317	4,294
Nonstocked forest land:			
Upland	1,887	1,748	450
Swamp	1,881	2,735	1,410
Total	3,768	4,483	1,861
Timber volume:		*Billion board feet*	
Total sawtimber	11.3	12.5	15.5
Softwood	6.3	5.0	6.6
Hardwood	5.0	7.5	9.0
		Billion cubic feet	
Total growing stock	6.4	7.2	9.8
Softwood	3.0	2.8	3.6
Aspen	1.5	1.8	3.0
Other hardwood	1.9	2.6	3.2
		Million cubic feet	
Timber cut-desirable cut:[2]			
All softwood:			
Annual cut	60	78	63
Annual desirable cut	49	96	116
All hardwood:			
Annual cut	50	76	63
Annual desirable cut	108	151	203

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[1] *In 1936 and 1953, this includes approximately 0.4 million acres reserved from timber production, some of which is productive timberland.*

[2] *This and other Forest Survey terms are defined in the Appendix.*

RESOURCE TRENDS

Volume Increases Abruptly

Since 1952 timber growth has added approximately 50 million cords to Minnesota's forests. During that time about 16 million cords of timber were harvested, leaving a net increase of 34 million cords.

The total volume, 124 million cords in 1962, is increasing by nearly 3½ million cords yearly. Waves of young trees, primarily in the northern counties, are reaching merchantable size in stands previously classed as "restocking." These account for much of the 37-percent increase in volume. Included in the growing stock are 15.5 billion board feet of sawtimber. This total, up 3 billion board feet since 1953, reflects a maturing of the second-growth trees. Growing stock volume increased from 5.0 to 7.3 cords per acre and, in several northern counties, exceeds 9 cords per acre. Statewide, average sawtimber volume per acre changed from 693 to 910 board feet. These trends are shown in the following tabulation:

	1936	1953	1962
Growing stock	*Million cords*		
Softwoods	37.8	35.4	45.7
Hardwoods	42.4	55.1	78.4
Sawtimber	*Million board feet*		
Softwoods	6,300	5,000	6,560
Hardwoods	5,000	7,500	8,959

Hardwood timber volumes have increased with each survey. The upward trend in softwood volume is recent: between 1936 and 1953 softwood volume diminished.

Aspen, spruce, jack pine, and paper birch, in that order, are the most prominent species groups (fig. 1); they include 55 percent of Minnesota's growing stock volume. Aspen accounts for about half of all hardwood volume. Paper birch has moved from the sixth most plentiful species in 1953 to third in 1962, just ahead of black spruce and balsam fir. Jack pine, black spruce, and aspen are favored for pulpwood; aspen and paper birch are potential veneer sources as their stockpile of larger trees expands. Since all four are short-rotation species, larger harvests in the near future seem warranted. Desirable cut estimates for these species rose sharply between surveys.

Aspen maintains its lead in sawtimber volume although it has less than white and red pine combined (fig. 2). Red pine, almost doubling in sawtimber volume, has moved ahead of jack pine to second place among the species. Growing stock and sawtimber volumes accumulated most rapidly in the Central Pine Unit, where the increase exceeds 60 percent in most counties. The increase was large but less uniform in other northern counties. Volumes were lower in southern and western Minnesota, except along the forested edge of the Red River Valley. Some of this decline is attributed to more stringent specifications for sawtimber trees.

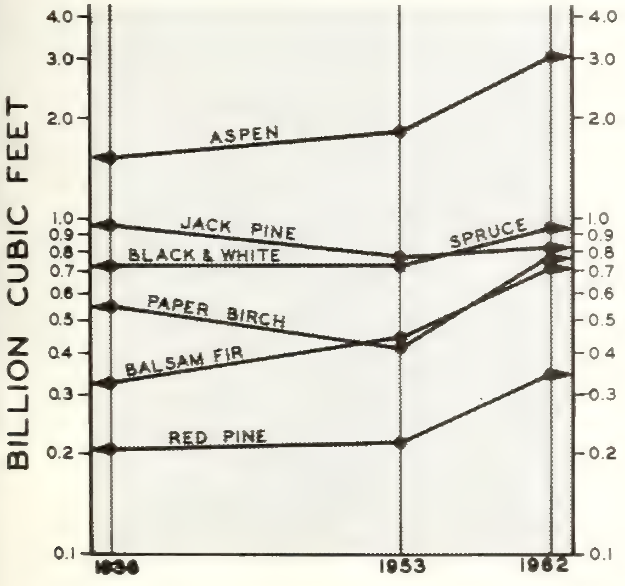


Figure 1.—Changes in growing stock volumes by species—1936, 1953, and 1962.

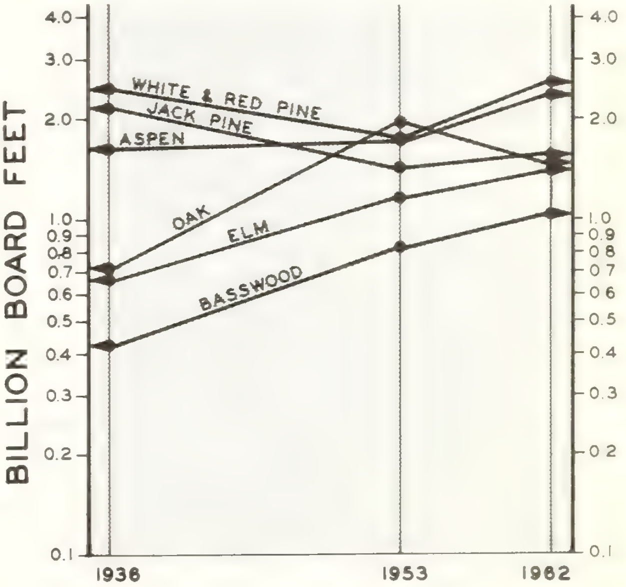


Figure 2.—Changes in sawtimber volumes by species—1936, 1953, and 1962.

Small trees still dominate the timber supply. Less than 10 percent of the 5.7 billion trees (over 3 inches in diameter) in the growing stock exceeds 9 inches d.b.h. (diameter at breast height). About 60 percent of the volume is in trees from 5 to 7 inches in diameter. Basal area averages 66 square feet per acre in trees 3 inches d.b.h. and larger — an average stocking of 330 trees per acre.

Annual Growth Now 5 Million Cords

Annual timber growth has increased since 1936, reflecting more and better stocking with younger and more vigorous trees. The increase in softwood species is overshadowed by the trend in hardwoods; three-fourths of the growth is in hardwood species. Growth statistics indicate there will be a higher proportion of hardwoods in future stands. Sawtimber growth has doubled since 1936 to about 800 million board feet yearly; 37 percent of it is in the softwoods.

Several questions have limited our analysis of growth trends for this Survey. Growth in the 1936 and 1953 Surveys was computed from measurements of tree rings. Mortality was based on counts of dead trees at sample locations. This procedure is inferior to direct remeasurements of sample trees, which was used in this Survey. It is also uncertain what the reduction of nearly one million acres of commercial forest acreage and the shifting of acreages to and from the forest status did to timber volumes previously associated with these acreages. We do know that the previously published growth estimates, interacting with interim estimates of timber cut, will not account for the changes in volume from 1953 to 1962.

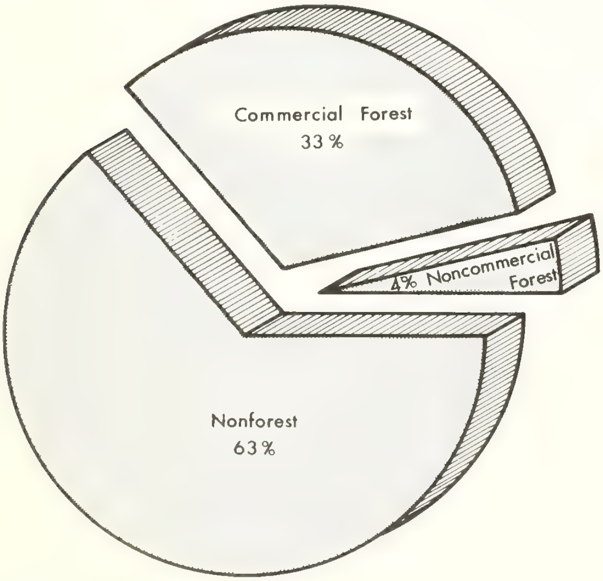


Figure 3.—Proportions of commercial forest, noncommercial forest, and nonforest land in Minnesota.

Aspen growth has increased steadily between succeeding Surveys and now contributes 46 percent of all growth. Red pine and jack pine contribute more than they did in 1953.

High mortality is offsetting growth somewhat. In 1962 nearly 1.8 million cords of timber were killed by disease, fire, insects, and miscellaneous natural causes. This loss is nearly a third as large as the annual net growth. Sawtimber mortality amounted to 17 percent of sawtimber growth. Liquidation of overmature stands (particularly in the Lake Superior Unit), better fire protection, and improved harvesting have reduced these losses since 1953. The risk is increasing, however, since more trees are now on slightly fewer acres.

Forest Area Is Slightly Reduced

Minnesota now has 19 million acres of forest land —3 percent less than 30 years ago (fig. 3). This small decline is due primarily to urbanization, new highway and utility rights-of-way, and other land clearing. These factors have not been offset by natural restocking and tree planting because most of this has occurred on land that is already classed as forest.

The commercial forest area is now estimated at 17.1 million acres, compared with 18.1 million recorded in the First Survey. The 6-percent decrease is deceptive, however. It reflects improved survey procedures, as well as changes in land use. A more objective method of site determination accounts for one-third of the decrease. The rest is associated with the land clearing activities, lake shore developments, and pasturing. A small part of this change resulted from expansion of parks and other reserved recreational areas. The decrease influences timber volume very little, since most of the reclassified area is marginal for growing tree crops or is lightly stocked.

Forest land as a percent of all land declines across Minnesota from the northeast, which is 80-percent forested, to the southwest, where some counties are less than 1 percent forested (fig. 4). The Arrowhead Country near Lake Superior is, in large measure, Minnesota's woodshed. It contains 16 heavily forested counties (see the forest type map on the inside of the back cover).

Most significant of the shifts in forest areas since 1953 is the sharp downturn in nonstocked acreage. More than 1.8 million acres are restocked, as a result of reforestation programs and natural regeneration associated with improved logging and better fire protection. About half a million of these newly stocked acres primarily support conifers, although over one million acres are newly stocked with hardwoods.

The aspen-birch type now covers a greater acreage than ever before: over one-third of the commercial forest area (fig. 5). More than one-fourth of the aspen-birch type found in the United States occurs in Minnesota.

The pine types have reversed their downward trend as tree planting gave red pine the largest rate of increase in any type since 1953.

The lowland hardwood type group (balsam poplar, cottonwood, and lowland hardwood types) continues to enlarge its acreage. Since 1936 it has expanded in acreage faster than other types, although not as fast as red pine during the fifties.

Of the major types, only jack pine and oak trend downward in acreage occupied.

The large expansion of timber volume is reflected in stand-size trends. Fully half of the commercial forest land supports poletimber stands, compared to one-fourth in 1936 (fig. 6). Sawtimber acreage has steadily increased, although it accounts for only 14 percent of the forest area.

This pattern should be expected in forests whose beginnings were largely in the first two decades of this century. Most hardwood stands originated in the twenties, coinciding with the beginnings of organized fire control. Conifer stands on the average are 40 to 60 years old. This age pattern was caused by the earlier logging of softwoods. The age distribution of softwoods is far less bunched than that of the hardwoods. This young-forest condition is responsible for the large volume increases in the past 10 years and the trend may well continue through at least the next decade. Because the hardwoods are younger, their volumes will probably increase faster (particularly aspen) than will those of softwoods.

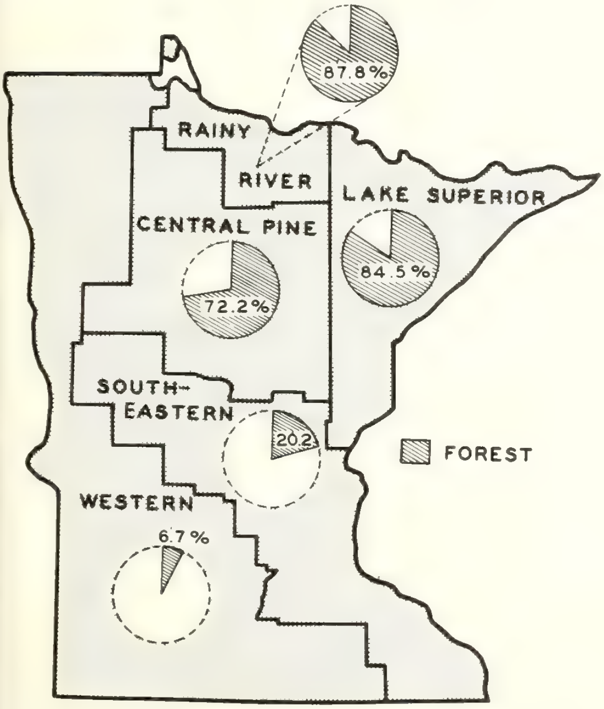


Figure 4.—Percent of forested land by district, 1962.

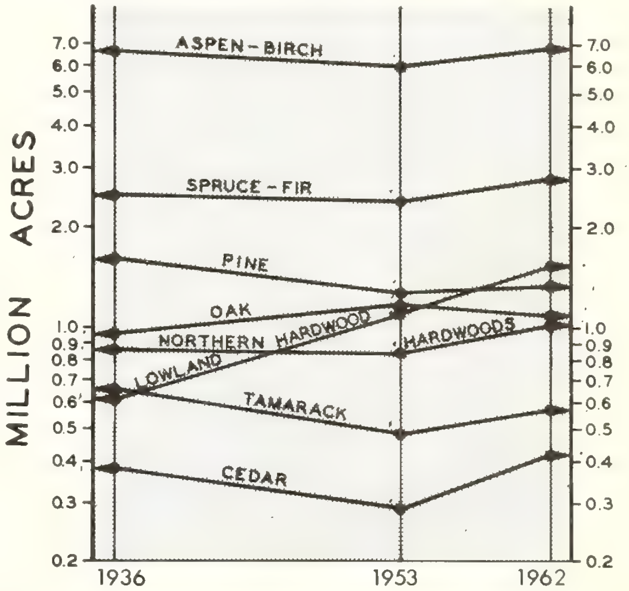


Figure 5.—Changes in commercial forest area by forest type—1936, 1953, and 1962.

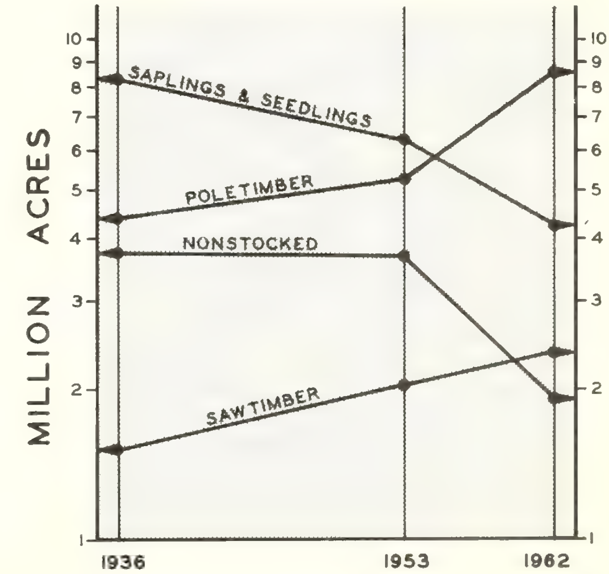


Figure 6.—Changes in commercial forest area by stand-size class—1936, 1953, and 1962.

Ownership Situation Unchanged

In contrast with the wholesale shifting of ownership during the Great Depression era, the relative amounts of Minnesota's commercial forest land in public and private ownership — 56 and 44 percent, respectively — have remained stable during the past 10 years (fig. 7). Within this generalization are many undercurrents of change — mostly localized. Exchanges between the Federal and State governments and between counties and various forest industries or other private owners have tended toward some consolidation of large holdings. A few of the larger ownerships have increased in size through land purchases. Subdividing is increasingly common where lands have substantial recreational value. The impact of these shifts on timber supply is unknown.

Eighty-two percent of Minnesota's commercial forest land is in the three northern Survey units, where 95 percent of the public and forest industry holdings also occur. Farmer and miscellaneous private ownership varies from 15 percent in the Rainy River Unit to 90 percent in the Southeastern Unit. In the 16 northern counties about 45 percent of the commercial forest land is divided nearly equally between county and State ownership. Two-thirds of the forest industry land is in three counties: Koochiching, St. Louis, and Lake.

Federal agencies own nearly 20 percent of the commercial forest land in Minnesota. Most of this is in two National Forests in St. Louis, Lake, Cook, Itasca, Cass, and Beltrami Counties.

Minnesota has more county-owned commercial forest land than any other State in the Union and is second only to Michigan in State forest acreage. However, forest industry owns less here than in Wisconsin, Michigan, or any of the southern States and several northeastern States.

Tree Planting Greens Half-Million Acres

The trees planted in Minnesota during the past 10 years outnumber those planted in all previous years. Altogether, the 609,000 acres planted — largely to pine — represent an impressive forestry achievement, especially when compared to the entire pine acreage in Minnesota: 1.3 million acres.

For years Minnesota planting lagged behind that of adjacent States; but from 1960 to 1963 more trees were planted in Minnesota than in any other State north of the Mason-Dixon line, and in 1963 Minnesota planted 46,000 acres to rank eighth nationwide. In 1964 Michigan and Pennsylvania planted slightly more. Over seven times as many trees were planted in 1964 as in 1950 (fig. 8). About 39 percent of the acreage reforested is private, 31 percent is Federal, and the remaining 30 percent is State and county land.

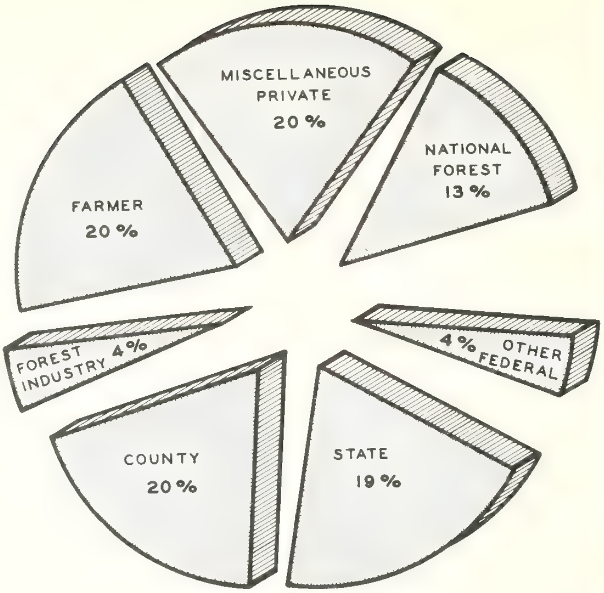


Figure 7.—Who owns Minnesota's commercial forests?

Most of the plantings have been pine, chiefly red pine, although all native conifers are used. The quantities of particular species planted fluctuate. Today, Minnesotans plant more white and black spruce and balsam fir and somewhat fewer white pine, jack pine, and the popular Christmas tree, Scotch pine.

Additional Data Provide Better Site Statistics

Minnesota's forests extend from the edges of deep, fertile prairie soils in the west and southwest to the shallow, cool forest soils north of Lake Superior. Because of its northerly location, the State has a short growing season. But for the same reason it has a very long growing day during this season. Its forests thrive under competition and sustain high growth with comparatively high numbers of trees per acre. This characteristic produces clean, low-taper trees of high quality.

Glaciation left a jumble of soil types and drainage patterns, across which sites change abruptly and range from very poor to excellent. Each tract of this forest land has an *inherent capacity* to grow wood, governed by such factors as soil quality, aspect, and drainage — one measure of this is site index. However, the *present capacity* to grow wood is limited not only by the inherent capacity but also by shortcomings in tree stocking, spacing, age, size, and quality. During the Third Minnesota Forest Survey several new kinds of information were collected that better gage all of these features. Even though this information was not collected in previous Surveys, some valuable site trends can be inferred.

Forest site indices across the State average about medium — capable of growing 50-foot trees in as many years. Over one-third of the commercial forests occupy medium sites. Another one-third grow on good or excellent sites, although less than one-tenth of all sites are excellent (growing trees 70 feet tall in 50 years). Half of the good and excellent sites grow aspen.

With full stocking and advanced forestry practices, Minnesota forests could produce about 1 billion cubic feet of commercial wood each year. Net growth is now 41 percent of this potential; likewise, timber cut is just 13 percent of what the forest land is capable of growing.

More Small Trees Decrease Quality

Although site quality intrigues foresters and land managers, tree quality commands the most attention in analysis of the present timber supply and demand situation. As with any raw material, wood with the least variability, lowest cost, and largest bundle of premium characteristics is most sought after. Traditionally, this has come from the large, straight trees with few defects — particularly those species whose lumber seasons well, machines cleanly and smoothly, and finishes easily. In recent years, as the pulp and paper industries eclipsed the solid wood industries, charactertistics such as pulp yield per cord, fiber length, bleachability, and ease of debarking have changed markets and added variety to determinations of timber quality and quality trends.

In this Survey, tree quality was evaluated from volume distributions by log grades and by tree sizes (d.b.h.). Many of the sawtimber trees in the field sample were log-graded. Much of Minnesota's 15.5 billion board feet of sawtimber is of low quality because it is in small trees — often in such species as aspen, jack pine, and paper birch, which rarely reach large diameters.

Loggers have picked over the larger trees among the preferred species for decades, leaving large amounts of second growth that is (due to its small size) grade 3 or poorer, mainly suitable for box and crate material, pallets, dunnage, timbers, and rough lumber. Only 9 percent of the softwood sawtimber and 22 percent of the hardwood sawtimber are in grades 1 and 2, fit for veneer and standard lumber.

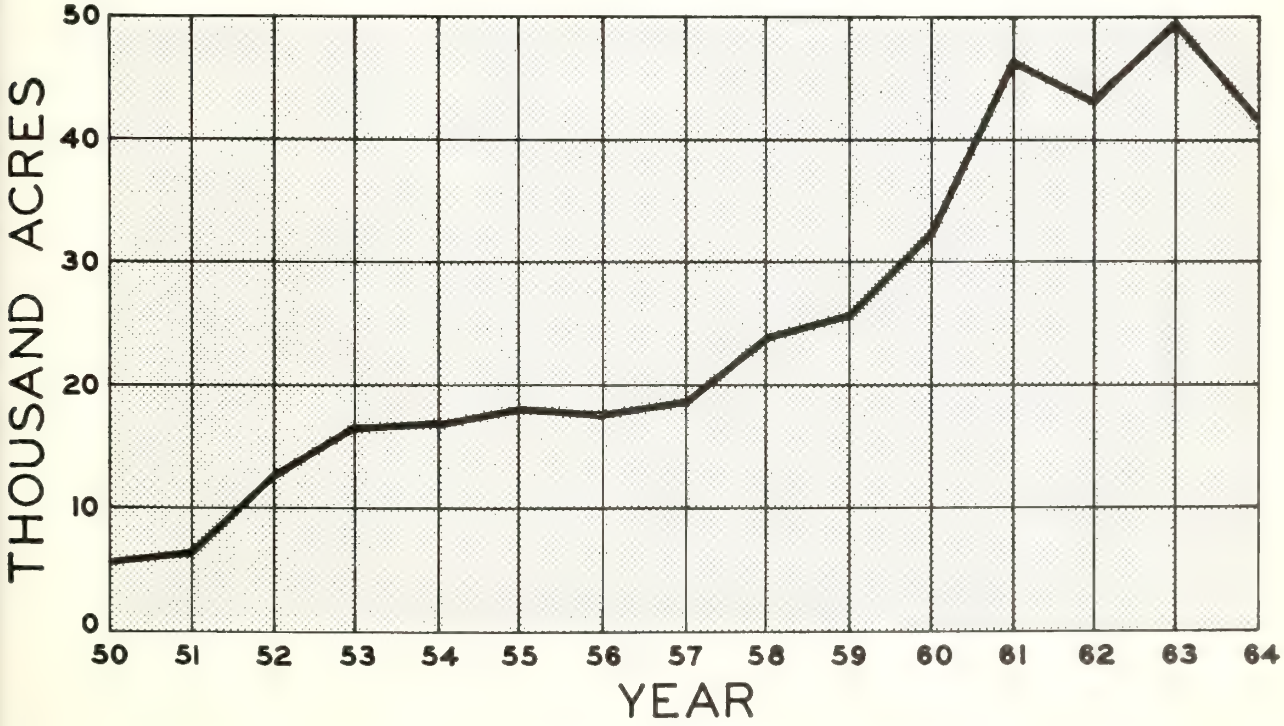


Figure 8.—Area planted to trees in Minnesota, 1950-1964.

The following is a comparison of 1936, 1953, and 1962 diameter distributions of hardwood sawtimber:

Diameter class	*Billion board feet*		
(Inches)	*1936*	*1953*	*1962*
11.0-14.9	3,000	4,626	5,910
15.0-18.9	1,500	1,809	2,071
19.0 and up	1,500	1,064	978
		Percent	
11.0-14.9	48	62	66
15.0-18.9	26	24	23
19.0 and up	26	14	11

As the sawtimber trees less than 15 inches d.b.h. grow, their quality will improve. Medium-sized sawtimber trees are maintaining their relative position. There has been no improvement in relative or absolute volume of very large trees. Lumber and veneer producers are not apt to detect much improvement in the supply of high-quality, large logs during the next decade, except in red pine, even though sawtimber volumes in high-quality smaller trees will accumulate, particularly in aspen and paper birch. The absolute volume in hardwood trees over 20 inches d.b.h. has remained about the same since 1953 (fig. 9).

At present, sawn products are coming from aspen trees and jack pine that were traditionally considered below saw log size. However, an increase of nearly 700 million board feet in aspen sawtimber since 1953 constitutes a rapidly expanding lumber, veneer, or plywood potential.

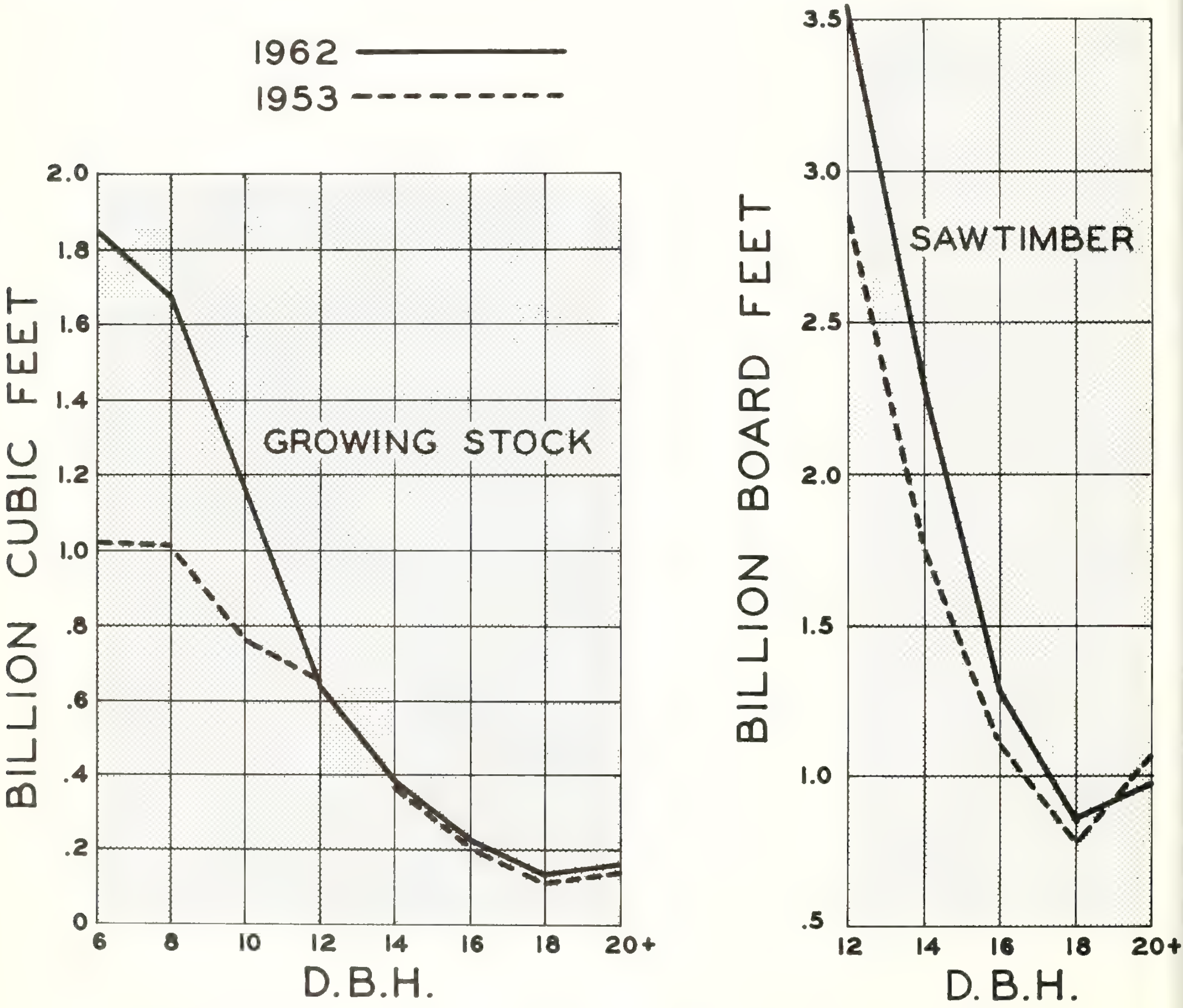


Figure 9.—Volume change in hardwood growing stock and sawtimber, by diameter classes, between 1953 and 1962.

Softwood volume in trees 20 inches d.b.h. and larger has increased slightly. Also, all smaller diameters show volume increases (fig. 10). The softwood sawtimber volume in 15- to 19-inch trees has more than doubled since 1953, with red pine, white pine, white spruce, and jack pine contributing most to the change. Quality will gradually improve as the younger trees grow larger.

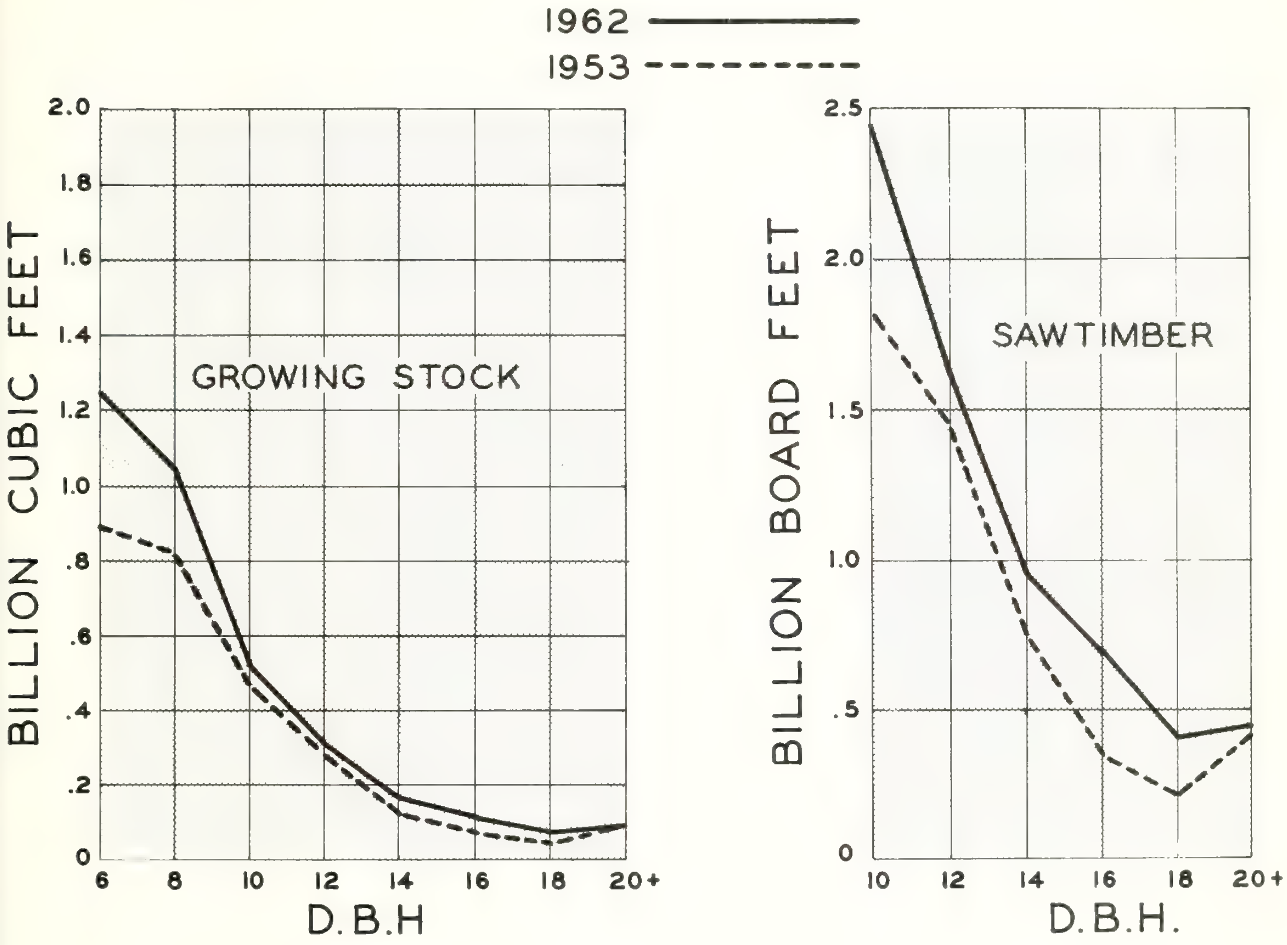
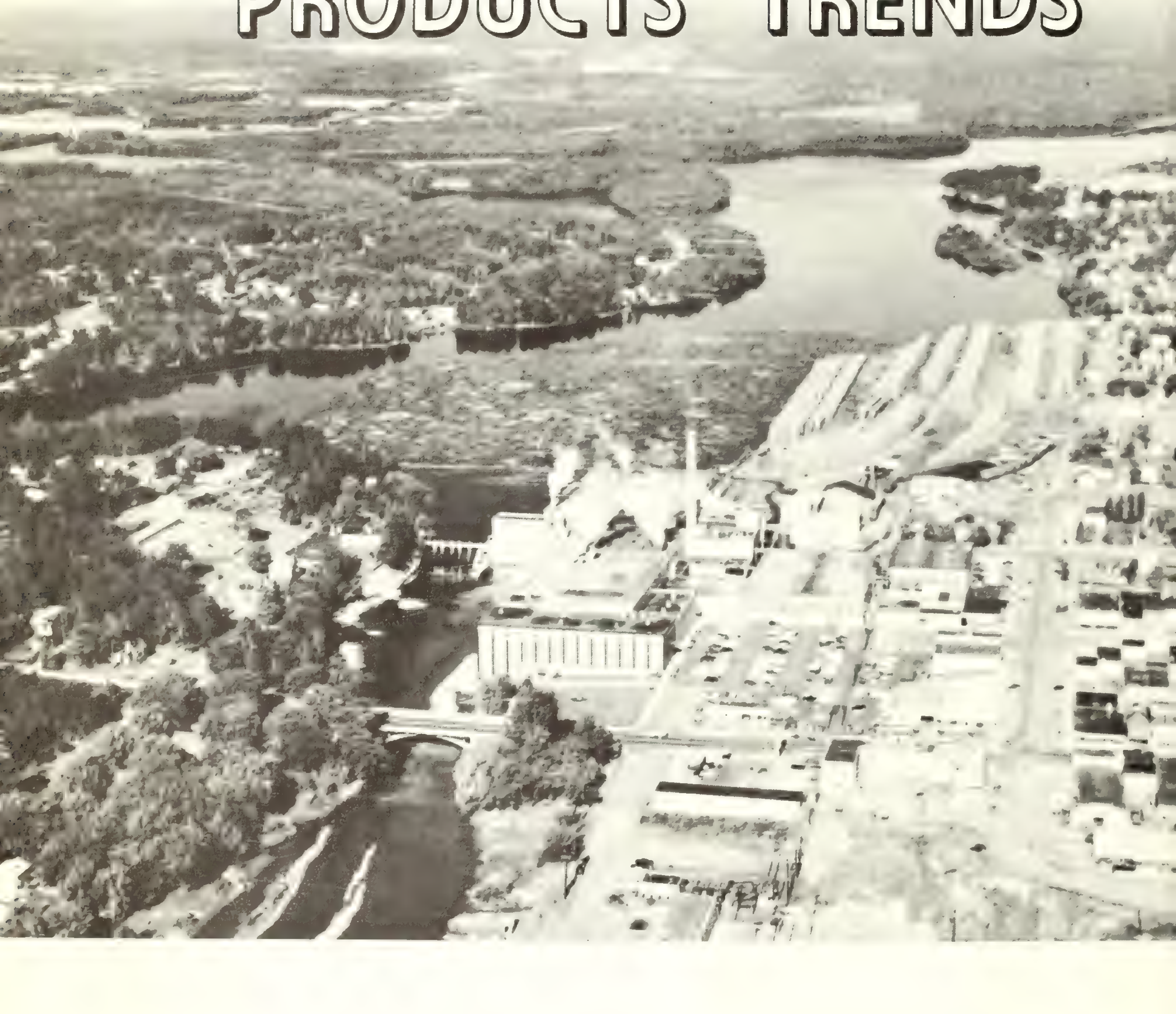


Figure 10.—Volume change in softwood growing stock and sawtimber, by diameter class, between 1953 and 1962.

PRODUCTS TRENDS



In 1958, timber-based activities added $456,000,000 to the State's gross product. This was 5.5 percent of the value of all goods and services produced in Minnesota—a percentage that was nearly identical to timber's share of the national economy.[1]

Timber Creates 58,000 Jobs

About 58,400 Minnesotans — one out of every 22 — were employed in timber-oriented industries in 1958. They were occupied as follows:

	Percent
Forest management	4
Harvesting	14
Primary manufacturing	11
Secondary manufacturing	15
Construction	28
Transportation & marketing	28

Timber-based economic activity merges into a multitude of other industrial, distribution, and marketing activities in the major population centers of southern Minnesota. In northern towns, especially International Falls, Grand Rapids, Cloquet, Bemidji, and Brainerd (as well as numerous smaller ones), wood-using industries contribute conspicuously to local economies. In 1958, pulp and paper industries alone employed over 11,500 people.

The economic impact of Minnesota timber spreads well beyond State borders, too; logs and bolts are shipped in considerable amounts to Wisconsin and other nearby States (fig. 11), as well as in limited quantities to Canada. Wood products from Minnesota find their way into markets throughout the Midwest.

Values, employment, and incomes also accrue from other substantial but nontimber forest products, such as outdoor recreation, fur, fish, and game. Minnesota's tourist and resort business flourishes in localities with spectacular forest scenery. Other nontimber products, such as berries, nuts, greens, maple syrup, tree seeds, and wild rice, support local enterprises. Black spruce Christmas trees from northern Minnesota swamps are sold across the continent.

State Has Over 1,300 Wood-Using Plants

In 1960, 1,345 plants located throughout the State were processing logs and bolts. These include 1,282 sawmills, 9 pulpmills, 7 veneer mills, 6 charcoal plants, 3 cooperage plants, and 38 other plants producing various wooden items such as matches, lath, dowels, and rustic fence. Between 1936 and 1953 the number of sawmills increased. It has since declined, but remains above the 1936 mark.

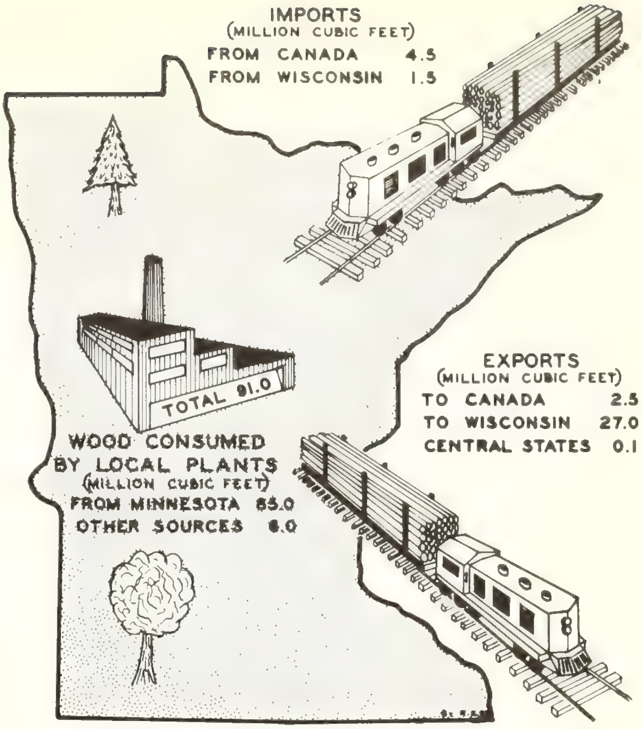


Figure 11.—Timber imports and exports, 1960.

The changing number of primary wood-using firms is shown in the following tabulation:

Kind of plant[1]	*1936*	*1953*	*1960*
Sawmills:			
Large[2]	8	3	1
Medium[3]	20	33	26
Small[4]	1,140	1,351	1,255
Pulpmills	8	9	9
Veneer plants	6	9	7
Excelsior plants	1	0	0
Charcoal plants	0	0	6
Cooperage mills	4	1	3
Misc. plants	56	27	38
All plants	1,243	1,433	1,345

[1] *Idle mills excluded.*

[2] *Annual lumber output in excess of 5 million board feet.*

[3] *Annual lumber output from 1 million to 5 million board feet.*

[4] *Annual lumber output less than 1 million board feet.*

The 162 million cubic feet of wood products cut during 1960 included 51 percent pulpwood, 25 percent fuelwood, 17 percent lumber logs, and 7 percent miscellaneous products. The 1960 production was

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[1] *Hair, Dwight. Economic importance of timber in the United States, U.S. Dep. Agr. Misc. Publ. 941. 1963.*

81 percent of the 1953 total and 66 percent of the 1936 total.

Nearly all of the decline in total production is attributable to reduced fuelwood use; pulpwood production increased considerably but not enough to offset this loss. Pulpwood output showed its greatest gain during and immediately after World War II. The other products, in total, have maintained a relatively even proportion of the total output.

Pulpwood Industries Expand

Pulpmills are the largest and fastest growing sector of Minnesota's wood-using industries. The 9 pulpmill installations have 12 distinct plants that employed over 11,500 people in 1958. Their capacity has expanded from 1,318 tons per day in 1952 to 2,162 tons per day in 1963 — an annual increase in excess of 6 percent. Most of the increase has been in mills using the semichemical process and those producing defibrated pulp for manufacturing items such as insulating board and hardboard. The pulp industry, which once made mostly spruce pulp for newsprint, now produces pulp for many types of paper, paperboard, and related products. The market for many of these items is nationwide.

Much of the pulpwood cut in Minnesota is consumed by Minnesota mills. Wisconsin mills and, to a much lesser extent, Michigan and Canadian mills also draw part of their pulpwood requirements from Minnesota. However, in recent years a smaller and smaller proportion of the harvest has been sold out of State. In 1963, State consumption amounted to 78 percent of the pulpwood production, although as late as 1949 nearly half was shipped out of the State.

Pulpmill capacity has expanded somewhat faster than pulpwood production, although Minnesota's pulpwood output has risen from 10,000 cords in 1900 to 376,000 cords in 1936 to 1,063,000 cords in 1963. The increased production has been accompanied by important shifts in species used. Between 1936 and 1960, as pulpwood output tripled, aspen replaced spruce as the principal pulpwood species. Aspen output multiplied nearly tenfold (fig. 12), and it is now used extensively for insulating board, hardboard, particleboard, and many types of papers. Pine pulpwood production approached that of spruce during the same period and, if current trends continue, will soon exceed it. Balsam fir contributes significantly to the pulpwood output (about 15 percent in 1960), despite some weakening of its current markets. Comparison of pulpwood production by species for 1936, 1953, 1960, and 1963 is shown in the following tabulation:

Species	*Pulpwood output (thousand cords)*[1] *1936*	*1953*	*1960*	*1963*
Aspen	42	270	392	433
Balsam fir	82	163	145	102
Birch, paper	0	2	1	*
Pine	48	194	225	208
Spruce	203	293	256	255
Tamarack	1	13	19	13
Misc. hardwoods	0	2	10	51
Residues	0	0	0	1
All wood material	376	937	1,048	1,063

[1] *Standard cords, roughwood basis.*

* *Less than 500 cords.*

New pulping processes have changed regional dependence on softwoods, shifting demand toward hardwood species. This trend will further reduce Wisconsin use of Minnesota pulpwood, since local hardwood supplies there are nearer the mills. The trend toward increased use of hardwood pulp also has opened markets for hardwood chips from sawmill residue. This has caused some sawmills to add log barkers and chippers in order to move slabs and edgings as pulpwood, although currently this has happened to a greater extent in Wisconsin and Michigan than in Minnesota.

Lumber Output Is Unchanged

Since 1936, lumber production has fluctuated with the general economy. No strong trend is evident, and total output remains about the same. Production reached a peak of 2½ billion board feet in 1902. By 1917 it had slipped below 1 billion board feet. It continued to decline sharply until 1933, when an estimated 80 million board feet were cut. From this low point, production increased to an annual level of 150 to 200 million board feet, where it now stands (fig. 13). In 1936 two-thirds of the lumber production was softwood; by 1953 only half was softwood. As shown in the following tabulation, declining pine and increasing aspen lumber production underlie this change.

Species	*Lumber output (Million board feet)* *1936*	*1953*	*1960*
White pine	61.1	22.2	21.4
Red pine	23.8	26.2	15.5
Jack pine	28.3	41.2	23.2
Spruce	3.8	3.6	2.8
Balsam fir	1.7	2.6	4.2
Tamarack	1.9	1.0	1.3
Cedar	1.4	2.0	2.1
All softwoods	122.0	98.8	70.5

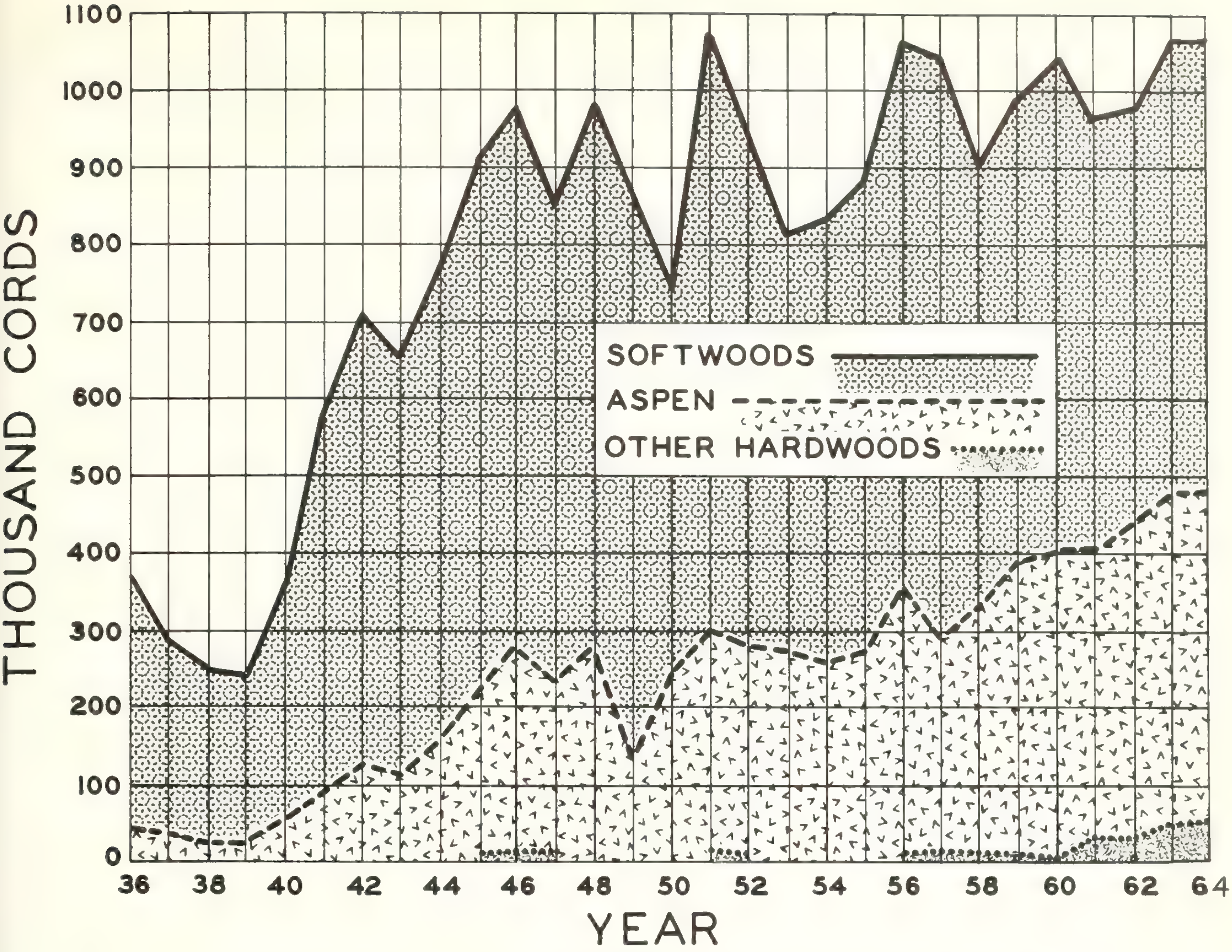


Figure 12.—Trend in pulpwood production by species groups, 1936 to 1963.

Maple	2.7	1.5	2.2
Birch	4.6	5.5	4.2
Basswood	5.3	9.8	8.9
Elm	2.6	9.3	8.9
Oak	7.6	20.9	18.6
Aspen	25.0	38.9	37.6
Cottonwood[1]	9.0	4.4	5.7
Ash	1.0	1.8	4.2
Walnut	*	.2	.2
Other hardwoods	.2	.2	.3
All hardwoods	58.0	92.5	90.8
All species	180.0	191.3	161.3

[1] *Includes balsam poplar.*

* *Less than 500,000 board feet.*

Several modern medium-sized sawmills were constructed recently in northern Minnesota that, while small by comparison with those in more important lumber-producing regions, represent a marked upgrading of equipment.

Miscellaneous Uses Shift

Timber is cut for several products other than pulpwood and lumber. Among these are veneer logs, posts, poles, piling, mine timbers, lath, match stock, and charcoal wood. Also, nearly 5 million Christmas trees are harvested annually in certain northern localities. Other Minnesota industries produce millwork, flooring, pallets, boxes, and treated posts and timbers.

Wood use changes over time as new products are developed and old ones lose favor. Aspen plywood may soon be produced in Minnesota. Wooden post consumption has dropped, due to substitution of steel posts and reduction in farm fencing as farms decreased in number and increased in size. Wood use by iron mines in northern Minnesota has fallen off, too, in recent years, as deep mines closed and production shifted to open-pit mining. Veneer logs, cooperage logs, and poles have shown moderate production increases since 1936, but piling, lath and shingle bolts, and various kinds of farm timbers are used less.

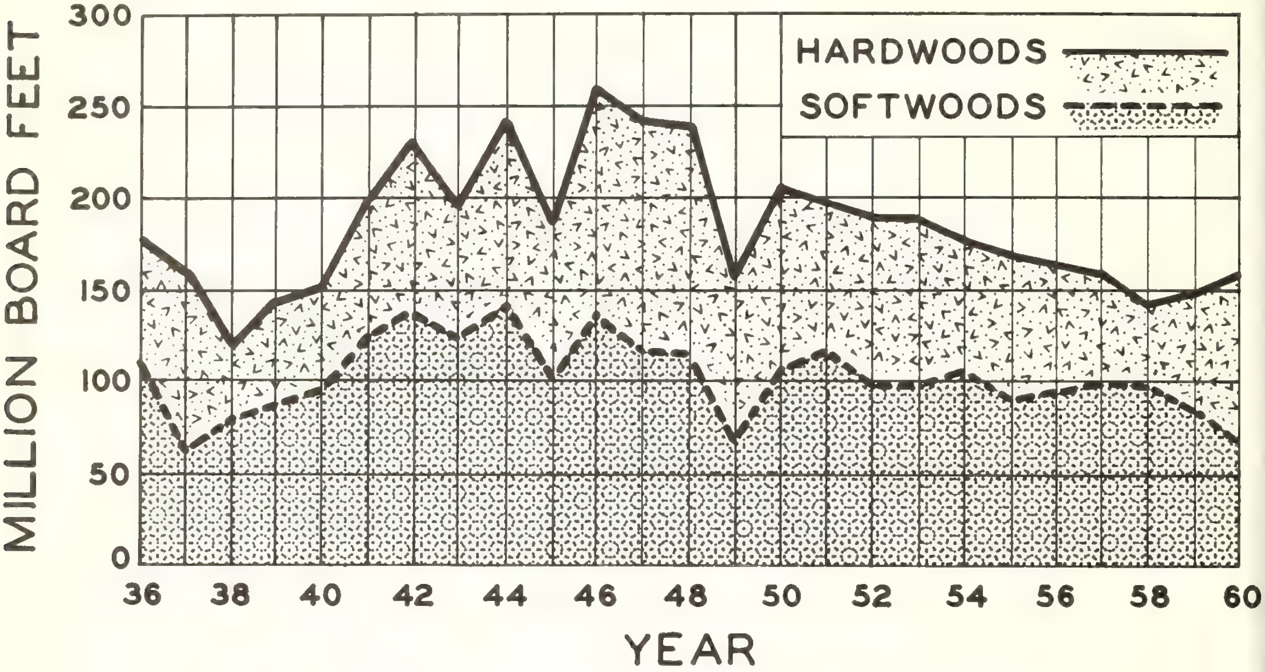


Figure 13.—Hardwood and softwood lumber production, 1936 to 1960.

INDUSTRIAL EXPANSION POSSIBILITIES

The timber supply varies with the area of commercial forest and with the interplay of growth, timber cut, and natural losses. To manage timber on a sustained-yield basis, the harvest over a long period cannot exceed growth. Wood crops differ from most crops in that the harvest represents many years' growth. Since timber products are cut primarily from the larger trees, these in turn must be replaced from a chain of maturing smaller and younger trees. Any deficiencies in the age chain in any species can cause supply irregularities — the age chain must therefore be balanced. Since a comparison of cut to growth does not take into account variations within age classes, the concept of desirable cut was formulated. Desirable cut is the level of cutting that will improve or maintain regular age class distributions and bring the whole forest nearer to "full" production. A complete definition is given in the Appendix.

Comparisons of desirable cut with timber cut and with timber growth estimates (figs. 14 and 15) uncover problems of surplus and deficit within the various species.

Overmature softwood stands will cause softwood desirable cut to exceed net growth for the next 10 years. In 18 northern counties there are over 7 million cords of overmature timber (10 or more years older than designated rotation); nearly 4 million cords are softwoods, chiefly jack pine, balsam fir, black spruce, and cedar, with very high mortality and almost no net growth. The bulk of these stands are near the Canadian boundary (in Cook, Lake, St. Louis, and Koochiching Counties) and in Itasca and Beltrami Counties.

The cut of hardwoods, found to be about equal to that of softwoods in the last two Surveys, is now slightly larger than the softwood cut. In 1960, jack pine, spruce, and balsam fir were the principal softwoods cut. Aspen, the principal hardwood, accounted for one-third of the total cut. The total cut of all species in 1960 was 19 percent less than the 1953 cut but still 14 percent more than the 1936 cut. Timber cut, as a percent of timber volume, declined from 2.1 percent in 1953 to 1.2 percent by 1960, to average less than 0.1 cord per acre per year of commercial forest.

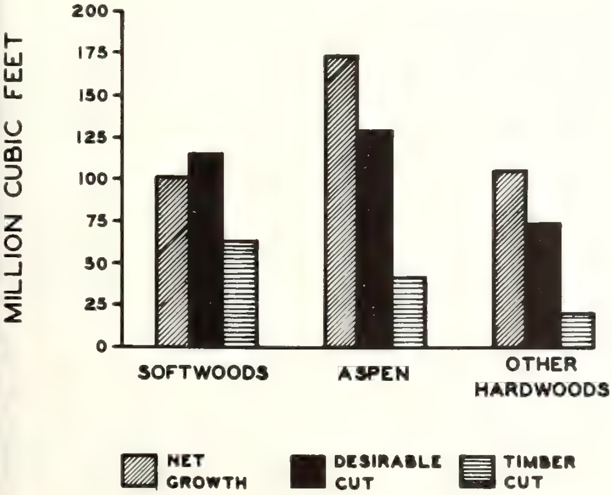


Figure 14.—Net growth, desirable cut, and timber cut of growing stock for softwoods, aspen, and other hardwoods.

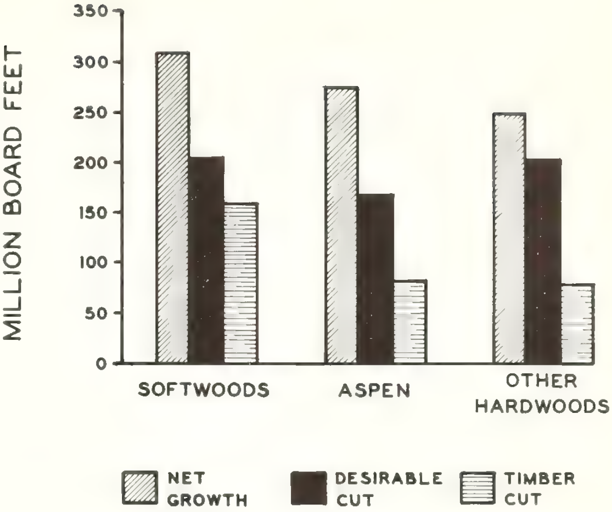


Figure 15.—Net growth, desirable cut, and timber cut of sawtimber for softwoods, aspen, and other hardwoods.

Desirable Cut Has Expanded Sharply

The annual desirable cut for the period 1962-1971 in Minnesota is 4 million cords, including 576 million board feet of sawtimber — a sharp expansion since 1936, as is shown below:

	1936	*1953*	*1962*
Growing Stock		*Million Cords*	
Softwoods	.6	1.2	1.5
Hardwoods	1.4	1.9	2.5
Sawtimber		*Million bd. ft.*	
Softwoods	195	223	205
Hardwoods	168	300	371

Only in softwood sawtimber during the last decade has the calculated desirable cut declined. Even this appears to be temporary, for softwood volume is increasing as poletimber grows into sawtimber.

The largest changes in softwood desirable cut are increases in balsam fir and cedar, which are underutilized. Of the hardwoods, aspen, balsam poplar, and paper birch show the most significant increases. However, the 50-million-cubic-foot increase in the aspen desirable cut dwarfs the other changes.

Harvest Lags, Surplus Increases

Timber cut has not kept pace with the rising desirable cut. Growing stock and sawtimber cut in 1936, 1953, and 1960 are shown below:

	1936	1953	1962
Growing stock		*Million cords*	
Softwoods	0.8	1.0	0.8
Hardwoods	0.6	1.0	0.8
Sawtimber		*Million board feet*	
Softwoods	145	138	160
Hardwoods	79	124	160

Despite rising timber supplies, timber cutting has actually declined since 1953. This trend toward a larger difference between desirable cut and actual cut is especially noticeable in northern Minnesota and, to a lesser extent, in southern Minnesota. Every owner group can harvest more timber, though farmers and miscellaneous private owners are cutting softwood sawtimber in excess of desirable cut. The "surplus," in terms of the physical volume of wood that could be harvested, is largest on county and State forests in northern Minnesota.

Statewide, the annual desirable cut exceeds the actual cut by over 2.4 million cords, revealing a potential harvest 2½ times the current yearly cut. The surplus has more than doubled (more than tripled for softwoods) since 1953, when it amounted to less than 1.2 million cords; the sawtimber surplus is about the same as it was, except that much more of it is now in hardwoods. Comparisons of surpluses in 1953 and 1960 are shown in the following tabulation:

	1953	1960
Growing stock	*Thousand cords*	
Softwoods	220	680
Aspen	590	1,100
Other hardwoods	360	660
Sawtimber	*Million board feet*	
Softwoods	85	45
Aspen	90	87
Other hardwoods	87	124

Aspen has the largest surplus (45 percent of the total, over a million cords), followed by balsam fir, paper birch, balsam poplar, jack pine, spruce, cedar, elm, and ash (fig. 16). Four species — aspen, jack pine, balsam fir, and spruce — lead in timber cut volumes. Even with their substantial markets, however, they are growing faster than they are being harvested. Pulpwood surpluses in northeastern and north-central Minnesota suggest industrial expansion possibilities, at least in terms of wood supply.

The decisions of 1965 concerning management of the Boundary Waters Canoe Area on the Superior National Forest will change the timber supply picture somewhat in St. Louis, Lake, and Cook Counties. Secretary of Agriculture Freeman announced that 150,000 acres were to be added to the no-cut reservation immediately and another 100,000 would be gradually included over a 10-year period. The exact boundaries of the revised no-cut zone are not established; hence, no adjustments were made in the statistics for this report.

Despite huge aspen surplus increases, there has been no increase in the cut. Rapid growth and extensive acreages of fairly young and well-stocked aspen stands may create an even larger surplus, unless use is greatly intensified. The present aspen sawtimber surplus of 87 million board feet suggests an untapped potential for sawn or sliced products. As most of the growing stock is on the verge of becoming sawtimber, this part of the aspen surplus may grow larger.

Even now, the aspen sawtimber surplus is the largest among all species, followed by elm, balsam poplar, balsam fir, cedar, jack pine, ash, paper birch, and hard maple (fig. 17). These are the same species that have surpluses in growing stock, except that hard maple has replaced spruce.

The sawtimber cut is about 260 million board feet below desirable cut, almost the same as in 1953.

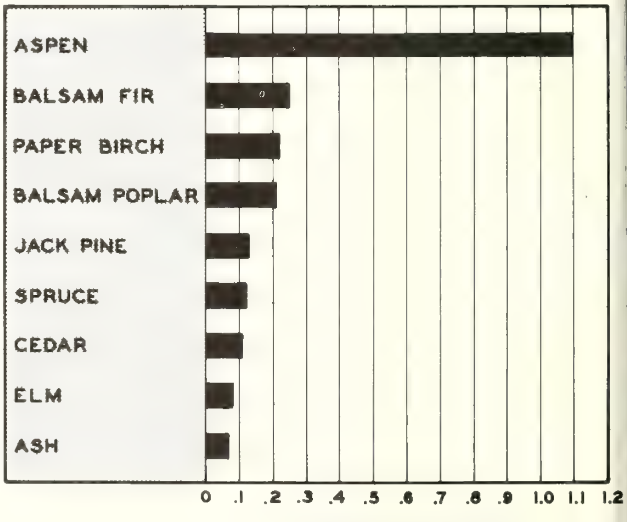


Figure 16.—Annual surpluses of important species. Larger markets needed soon to harvest desirable cut.

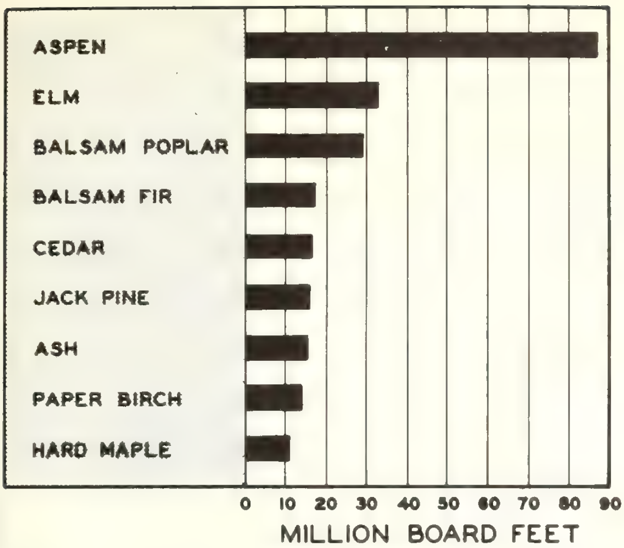


Figure 17.—Annual sawtimber surpluses for important species.

This apparent stability, however, conceals increases in desirable and actual cut of about 60 million board feet each. Also, the overall composition of the surplus has changed. The softwood sawtimber decline of nearly 50 percent was offset by increased hardwood surpluses.

The sawtimber surplus is more widely distributed and less concentrated than the surplus of growing stock. The surplus in softwood sawtimber in the Lake Superior Unit amounts to 30 million board feet. No other unit has as much as 10 million feet surplus softwood timber. The Lake Superior Unit also has 70 million board feet of surplus hardwood sawtimber, including 50 million feet of aspen. The Central Pine Unit could cut about 75 million more board feet of hardwood sawtimber each year, including 30 million feet of aspen.

Economic Factors Limit Actual Cut

Actual cut depends upon interactions between the production costs incurred by wood-using industries and the prices they receive for their products. Whether much of the increasing surplus can be used in the near future hinges on possible economic changes that would suggest profitable opportunities and thus would encourage wood processors to expand their operations in Minnesota. Improvements in timber supply alone may not lead to a larger timber cut, although the expanding timber supply generates a positive pressure by encouraging industries to install larger capacity mills that operate more efficiently.

Minnesota's timber supply is widely dispersed in relatively low volumes, generally in the range of 5 to 25 cords per acre. Conversely, the pulpmills and, to a somewhat lesser degree, other major timber processors are concentrated at relatively few locations. The latter are mostly small operators who use only certain types of raw materials. These conditions have tended to create zones, remote from mills, where timber is cut only in peak demand periods. The situation is further complicated by timber supplies in several species that have very limited use under present conditions.

The surplus, therefore, generally lacks something in terms of location, species, or size, which makes it undesirable for existing wood-using industries at present levels of consumption.

Transportation and market patterns, too, have been comparatively disadvantageous for wood-using industries in Minnesota. The timber is largely to the north and northeast — much of it tucked around the corner of westwardly protruding Lake Superior — some distance from major Midwestern population centers. While markets are located to the south, the major railroads transect Minnesota east and west. Interline rates thus penalize product movements between source and markets. The St. Lawrence Seaway and planned interstate highways may diminish this disadvantage.

THIRTY-YEAR OUTLOOK

Larger Timber Resource Projected

The past 30 years have shown a basis for further expansion of timber supplies in the next 30 years. Minnesota's future timber situation will be affected by various factors: the physical timber supply, new harvest and transportation developments, a growing population, new wood products, improved processes, and different distributing and marketing channels.

The location of the timber supply is subject to changing land use patterns. Even as reforestation adds productive forest acreage, other lands are diverted to nontimber uses. During the last 25 years timber supplies have been increased by fire protection, insect and disease control, and improved cutting practices. The stands are becoming denser and older. Many of the better planting sites are now reforested. Future improvements will depend upon decisions to make further investments in forest management.

Recent timber volume trends indicate larger future supplies. By 1992 growing stock volume is expected to increase about 75 percent, net growth about 15 percent, and timber cut 60 percent over 1962. Sawtimber volume should nearly triple. In general, the forests will be better stocked and more productive than they are now. Hardwood cubic-foot volume will double, but for softwoods only a 10-percent increase is anticipated.

Timber growth and cut have been projected for 1972, 1982, and 1992. These projections assume that: (1) annual timber products output in Minnesota will rise along with estimated increases in population and income; (2) wood will maintain its relative position in the national economy; (3) tree planting will continue at the rate indicated by recent trends; and (4) timber utilization will improve, i.e., more of each tree harvested will be converted into useful products. The projections are also predicated upon expected increases in industrial demand for timber products, continuing reforestation at a high level, natural losses as revealed by past trends, and other changes that will lead to a more productive forest and, hence, a higher desirable cut.

Resource projections are inherently speculative, since the future forest resource situation depends on numerous man-directed factors. These projections are not forecasts, for as they reveal potential supply problems and opportunities they also serve to trigger needed modifications. Timber resource projections amplify trends, indicating potential supply limitations, and thus give resource planners and timber users time to adjust future supplies to specified needs. Minnesota's forests can produce far more wood than is projected during the next 30 years. New knowledge from current research will certainly raise this capacity.

The projections are based on present diameter distributions and recent studies of diameter growth, tree mortality, and timber cut. They indicate that Minnesota's forests will have larger percentages of aspen and hardwood volume in 1992 than in 1962.

The physical supply of timber will increase, along with cut and mortality. Future softwood volumes will be mostly in trees 8 to 14 inches d.b.h., with fewer very large and very small trees and a slight but gradual reduction in growth.

Aspen seems likely to continue its recent expansion of volume. Annual aspen growth is increasing slowly but steadily. By the year 2000 it will be nearly 10 percent more than it is today. The anticipated increase in aspen timber cut from 43.3 million cubic feet to 54.4 will be less than losses due to mortality. Aspen sawtimber volume should more than triple. By 1972 the total aspen volume will be greater than that of all softwoods or all other hardwoods.

The projections indicate a substantial increase of hardwood volumes in all sizes except trees with d.b.h. larger than 22 inches. By 1972, hardwoods other than aspen will have more volume than softwoods. Average timber volumes during the next two decades will increase from the present 7.3 cords per acre to nearly 11 cords.

Marketing Importance Grows

With the timber supply expanding, with tree stocking moving toward capacity levels, and with a large sector of the forest approaching maturity, our main attention can shift somewhat from timber supply to timber industry and marketing problems. The payoff for a resource comes with use.

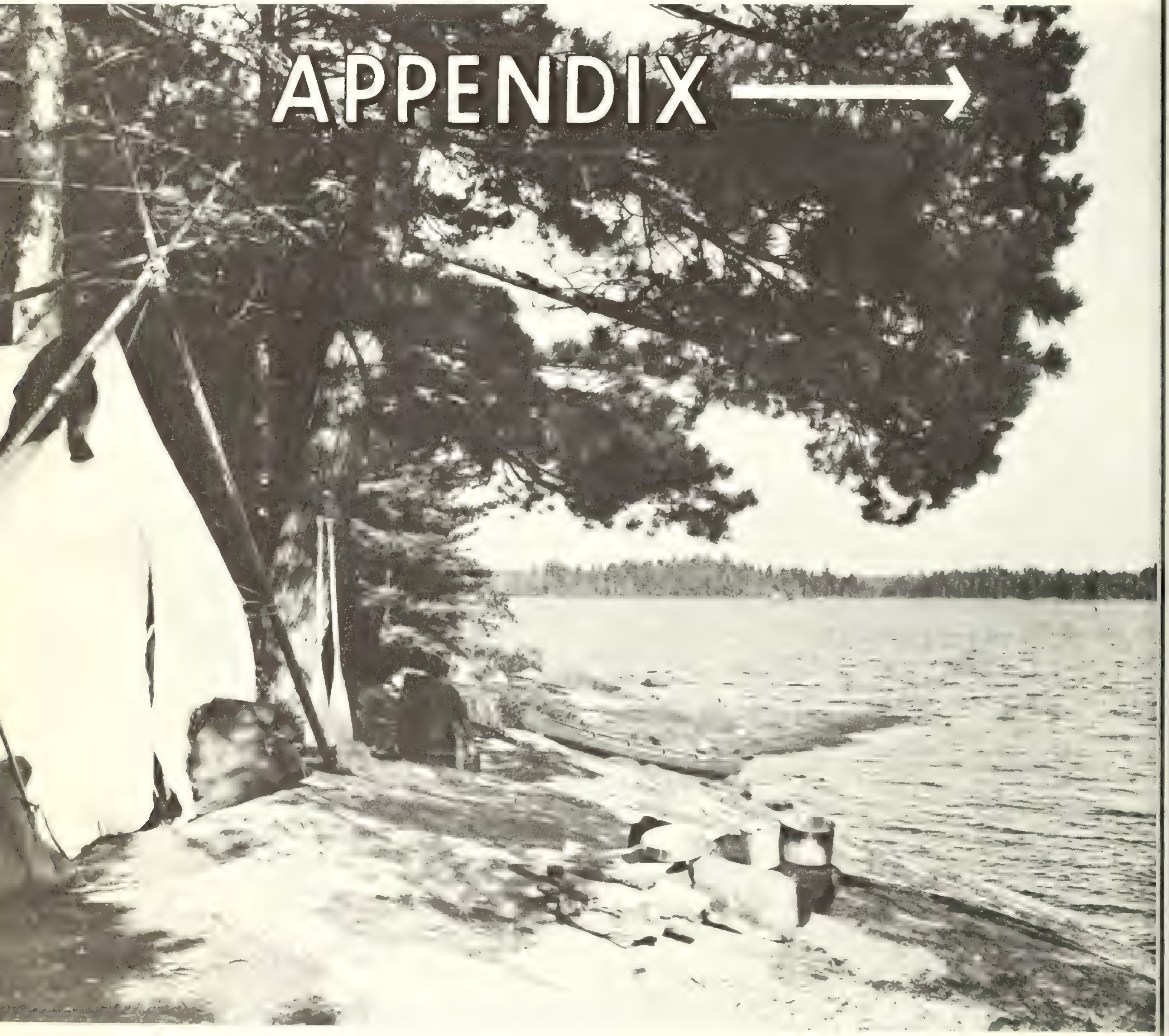
A new era of mechanized harvest began with the gasoline-powered chain saw, but such improvements still lag well behind those of many other industries. More mechanization seems certain; whole-tree logging, timber harvesting combines, hydraulic loading and lifting devices, portable log debarkers, chippers, versatile and swift rubber-tired skidders, and even rail cars built to meet log transportation specifications are slowly changing the character and economics of timber harvesting.

Affecting wood manufacturing are new dense hardwood pulping processes and new products, such as particleboard. Production of aspen plywood, other small-log veneer, and wood chips for foreign markets are other possibilities under study.

Minnesota now exports annually 375,000 cords of wood — mainly to Wisconsin pulpmills, but also to Michigan, several Central States, and Canada. Changing timber supplies may affect these markets, as may industrial expansion in Minnesota. Trends in exports, product use, and capacity of wood-using industries throughout the region will affect the complexion of wood-based industrial development. Since total wood supply will increase faster than log quality can improve, industries that use wood fiber or particles will have more abundant sources of raw material before lumber and veneer producers note greater supplies of high-quality logs.

Defining and developing additional markets for an increasing forest resource offers Minnesota an economic challenge, now that the rebuilding of the once largely depleted forests is well on the way to being realized.

APPENDIX →



Accuracy of Survey

Estimates of forest area and timber volume are subject to two kinds of error: sampling errors and human errors (mistakes in judgment, recording, calculation, and compilation).

Sampling errors, which are measurable, are reduced to a minimum through the sampling design and the sample size. Nonsampling errors are not measurable, but are minimized through close supervision and adequate training of employees and through rechecking of all work phases.

Substantial contributions from cooperating agencies and companies permitted the sample accuracy in Minnesota to greatly exceed minimum national standards. The sampling error is ± 0.2 percent for total forest area and ± 0.9 percent for total timber volume. This means that two out of three duplicate surveys would find the forest area within these percentages of the State totals reported here. As these totals are subdivided into detailed statistics — forest type, species, tree diameter—the sampling error increases and is greatest for the smallest items.

The following tabulation illustrates the estimated sampling error for a range of acres and volumes:

Sampling error (Percent±)	*Forest area (Thousand acres)*	*Timber volume (Million cu. ft.)*
0.2	17,062.0	—
.9	1,000.0	9,801.8
1.0	902.0	8,830.7
2.0	225.5	2,207.7
2.97	102.3	1,000.0
3.0	100.2	981.2
4.0	56.4	551.9
5.0	36.1	353.2
10.0	9.0	88.3
15.0	4.0	39.2
20.0	2.3	22.1
40.0	.6	5.5

Survey Procedure

Forest area, volume, and growth statistics were compiled from sample survey data. Area and volume estimates from the Superior and Chippewa National Forests were supplied by the Eastern Region, U.S. Forest Service. The Minnesota Department of Conservation, Minnesota and Ontario Paper Company, Koochiching County, and Kimberly-Clark Corporation provided data for their ownerships. In general, this information was obtained from aerial photographs and from sample plots examined on the ground.

The Forest Survey of lands not covered by these cooperators employed a three-stage sampling procedure. First, many points were examined on aerial photographs to determine the proportions of forest and nonforest area. These proportions, multiplied by gross land area, produced the basic area estimates. Then a subsample of the forest points was further analyzed and photomeasured to estimate forest type, stand-size, and density. Finally, a subsample of these photo plots was systematically selected and measured on the ground to check photo classifications.

Ownership of commercial forest land in northern Minnesota was compiled from complete tabulations of official county ownership records. In southern Minnesota, ownership was based on the field sample. Timber volume was based on tree measurements. Growth and mortality were calculated from remeasurement of permanent plots.

The information thus gathered was edited, coded, and punched for computing and tabulating. These figures were combined with similar estimates furnished by cooperators to prepare the area, volume, and growth tables presented in this report.

Timber cut and forest products output were estimated for 1960 from data in forest industries production reports, stump counts from forest inventory plots, cutting records from industrial and public owners, and utilization factors based on a logging residue study.

Definition of Terms

Land-Use Classes

Land area.— The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and flood plains, streams, sloughs less than one-eighth mile wide, and lakes, reservoirs, and ponds smaller than 40 acres.

Forest land.— Land now or formerly at least 10-percent stocked by forest trees of any size and not currently developed for nonforest use. Excludes urban or thickly settled residential and resort areas, city parks, orchards, farmsteads, improved roads, or lands developed and maintained for nonforest use by fencing, seeding, etc. The minimum forest area classified was one acre. Roadside, streamside, and shelter-belt strips of timber at least 120 feet wide qualified as forest land. Unimproved roads and trails, streams, and clearings less than 120 feet wide in forest land were also included.

Commercial forest land.— Forest land which does or can produce crops of industrial wood and which is not withdrawn from timber utilization by statute or administrative regulation.

Noncommercial forest land.— Unproductive forest land incapable of yielding crops of industrial wood, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Forest Types

A classification of forest land based upon the species forming a plurality of stocking. Stocking is based on the area occupied by the present tree cover. This differs from the 1947 Lake States standards, which characterized a type upon the species forming a plurality of the volume in the stand. The following types were recognized in the Minnesota Survey:

White pine. — Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Red pine.— Forests in which red pine (Norway) comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

Jack pine.— Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Balsam fir.— Forests in which balsam fir comprises a plurality of the stocking. (Common associates include white spruce, aspen, maple, birch, white-cedar, and tamarack.)

White spruce.— Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, white-cedar, and tamarack.)

Black spruce.— Forests in which black spruce comprises a plurality of the stocking. (Common associates include tamarack and white-cedar.)

Tamarack.— Forests in which tamarack comprises a plurality of the stocking. (Common associates include black spruce and white-cedar.)

White-cedar.—Forests in which white-cedar comprises a plurality of the stocking. (Common associates include tamarack and black spruce.)

Northern hardwoods.— Forests in which maple, yellow birch, and basswood, singly or in combination, comprise a plurality of the stocking. (Common associates include elm and white pine.)

Oak.— Forests in which upland oaks, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Lowland Hardwoods.—Forests in which elm, and ash, singly or in combination, comprise a plurality of stocking. (Common associates include cottonwood, maple, and balsam poplar.)

Balsam poplar.— Forests in which balsam poplar comprises a plurality of stocking. (Common associates include elm, ash, maple, and cottonwood.)

Aspen.— Forests in which quaking or bigtooth aspen comprises a plurality of stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.— Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Grass and upland brush.— Productive uplands supporting grass and/or upland shrubs (hazel, sumac, mountain maple, juniper, etc.), from which forest trees have been removed to less than 10 percent stocking. Includes permanently abandoned fields but not prairie grass areas where trees never existed.

Lowland brush.— Productive lowland supporting lowland shrubs (alder, willow, dogwood, Labrador-tea, etc.), from which forest trees have been removed to less than 10 percent stocking.

Ownership Classes

National Forest.— Federally owned land within National Forest boundaries and other lands under the administration of the Forest Service.

Indian.— Tribal lands held in fee by the Federal Government but administered for Indian tribal groups and Indian trust allotments.

Other Federal.— Federal lands, other than National Forest or Indian, in military reservations, wildlife refuges, etc.

State.— Lands States own or have leased for more than 50 years; State Forests, etc.

County and municipal.— Lands counties or municipalities own or have leased for more than 50 years.

Pulp and paper companies.— Fee simple lands of pulp and paper companies; excludes leased lands.

Lumber companies.— Fee simple lands of lumber producers of 100,000 board feet per year; excludes leased lands.

Other wood-using industries.— Lands owned by all primary and secondary wood-using industries; sawmills, veneer plants, handle mills, furniture factories, etc.

Farmer owned.— Lands owned by operators of farms, retired farmers, or wives of farmers. A farm must include 10 or more acres and must yield $50 or more annually from agricultural products or, if less than 10 acres, the yield must be at least $250 annually. Forest land owned by a farmer is classified as farmer-owned, whether or not the tract contains an agricultural operation, unless the owner operates a forest industry. Lands leased by farm operators from such owners as railroads, States, and pulp companies are not considered to be farmer-owned.

Miscellaneous private.— Privately owned lands other than forest-industry or farmer-owned.

Stand-Size Classes

Stand-size class is based on the predominant size of timber present— sawtimber, poletimber, or saplings and seedlings.

Sawtimber stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by sawtimber trees.

Poletimber stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by poletimber trees.

Sapling and seedling stands.— At least 10-percent stocked with growing stock trees and with a plurality of stocking by saplings and seedlings.

Nonstocked.— Commercial forest land less than 10-percent stocked with growing stock trees.

Area Condition

Area condition classes on commercial forest land are based upon levels of desirable stocking and other conditions affecting current and prospective tree growth.

A desirable tree is a healthy dominant or co-dominant tree with (1) a crown more than one-third filled with foliage of good color and normal size; (2) no apparent physical weaknesses, pathogens, or insects present that are likely to kill or seriously deteriorate the tree within 10 years; (3) less than 10 percent loss of scale; (4) prospective or immediate yield of at least one grade 2 saw log or two 100-inch sticks of pulpwood. Any tree of commercial species meeting the above specifications was classed desirable if it was 3 inches d.b.h. or larger; if smaller, it had to be of a species suitable for the type.

Using these qualifications, the following condition classes were established:

Desirable.—Areas 70-percent or more stocked with desirable trees.

Moderate and favorable.— Areas 40- to 70-percent stocked with desirable trees, with 30 percent or less of the remaining area controlled by other trees, inhibiting vegetation, or surface conditions that will prevent occupancy by desirable trees.

Moderate and unfavorable.— Areas 40- to 70-percent stocked with desirable trees, with more than 30 percent of the remaining area controlled by other trees, inhibiting vegetation, or surface conditions that will prevent occupancy by desirable trees.

Poor but favorable.— Areas less than 40-percent stocked with desirable trees, with adequate seed source and seedbed favorable for natural restocking.

Poor and unfavorable.— Areas less than 40-percent stocked with desirable trees, with inadequate seed source or seedbed unfavorable to natural regeneration.

Site Classes

Site classifications indicate quality of forest land for raising timber products. Site index is the expected height of a free-growing tree at age 50. These classifications are derived from age and total height measurements of a dominant tree in the main stand on each plot. The site indices for this Survey were grouped by type into excellent, good, medium, or poor, according to the ranges in table A.

Table A.— *Guide for using site classes for Third Minnesota Forest Survey, by types, 1960-1962*

Forest type	Index for:			
	Excellent site	Good site	Medium site	Poor site
White pine	76+	66-75	56-65	45-55
Red pine	66+	57-65	47-56	35-46
Jack pine	73+	60-72	47-59	34-46
Balsam fir	61+	51-60	41-50	30-40
White spruce	66+	56-65	46-55	35-45
Black spruce	43+	36-42	30-35	23-29
Tamarack	58+	48-57	38-47	27-37
Cedar	46+	36-45	26-35	20-25
Northern hardwoods	71+	61-70	51-60	40-50
Oak	71+	61-70	51-60	40-50
Lowland hardwoods	71+	61-70	51-60	40-50
Balsam poplar	76+	66-75	56-65	45-55
Aspen	76+	66-75	56-65	45-55
Paper birch	66+	56-65	48-55	38-47

Stand-Age Classifications

Stand-age classifications are determined from the age of the main stand for both even- and uneven-aged stands.

Tree Classifications

Sawtimber trees.— Live trees of commercial species at least 9.0 inches d.b.h. for softwoods and 11.0 inches d.b.h. for hardwoods, containing at least one merchantable saw log.

Poletimber trees.— Live trees with good vigor and form of commercial species 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods.

Saplings and seedling trees.— Well established live trees of commercial species less than 5.0 inches in diameter and of good form and vigor.

Sound cull trees.— Live trees of sawtimber or poletimber size that are unmerchantable for saw logs, now or prospectively, because of roughness, poor form, or species.

Rotten cull trees.— Live trees of sawtimber or poletimber size that are unmerchantable for saw logs, now or prospectively, and with more than 50 percent of the defect due to rot.

Salvable dead trees.— Standing or down dead trees that are currently merchantable.

Diameter Measurements

Diameter at breast height.— The diameter of a tree at 4.5 feet above average ground level.

Diameter class.— Trees in a 2-inch diameter range, ranging from 1.0 inch below the midpoint of the class to 0.9 inch above the midpoint, e.g., the 6-inch class would include trees from 5.0 to 6.9 inches d.b.h.

Volume Classifications

Cord.— The amount of stacked wood contained in a pile whose dimensions indicate a gross volume of 128 cubic feet; equivalent to 79 cubic feet of solid wood.

Board foot.— A unit of measure for lumber one inch thick with one square foot of surface.

Growing stock volume.—Net volume in cords or cubic feet of all live, merchantable sawtimber and poletimber trees of all commercial species, from stump to a minimum 4.0-inch top diameter outside bark, on commercial forest land.

Sawtimber volume.— Net volume in board feet, International 1/4-inch rule, of live merchantable sawtimber trees on commercial forest land. Minimum top diameter is 8.0 inches outside bark.

Log Grades

Sawtimber trees were graded with three standards, depending on species: (1) Hardwoods other than aspen were graded according to "Hardwood Log Grades for Standard Lumber," published by the U.S. Forest Products Laboratory in 1953; (2) aspen was graded according to "Aspen Lumber Grades and Characteristics," U.S. Lake States Forest Exp. Sta., Aspen Report No. 6, 1948; (3) softwoods were graded according to "Specifications for Log Grades of Hardwoods and Softwoods," Northern Hemlock and Hardwood Association, 1947.

Hardwood log grades include, in addition to the above, a grade 4 or tie and timber grade. A tie and timber log had to be sound internally, with no single knot or group of knots within any 6-inch section exceeding one-third the log diameter at that point. Rotten defects or holes could not extend more than 3 inches into a potential log or timber. Sweep could not exceed one-fourth the scaling diameter in any 8 feet of length.

Growth

Net annual growth.— The annual change in volume of sound wood in live sawtimber and poletimber trees on commercial forest land and the total volume of trees entering these classes through ingrowth, less natural losses.

Growing stock growth.— Net annual growth of poletimber and sawtimber trees in cords or cubic feet.

Sawtimber growth.— Net annual growth of sawtimber trees in board feet, International 1/4-inch rule.

Timber Cut

Annual actual cut of growing stock.— The net cubic-foot volume of sawtimber and poletimber trees harvested and that killed by logging damage, land clearing, and cultural operations during a specified year.

Annual actual cut of sawtimber.— The net board-foot volume of live sawtimber trees harvested and that killed by logging, land clearing, and cultural operations on commercial forest land during a specified year.

Timber products output.— The volume of rough forest products cut from growing stock, cull and dead trees, limbwood, etc.

Logging residue.— The net cord volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

Desirable Cut

Annual desirable cut (formerly called allowable cut).— The net volume of live sawtimber and poletimber trees that can be commercially harvested annually during the next 10 years while maintaining or building a high level of growing stock and a reasonably even distribution of age classes below the rotation age selected for each type. It includes harvest cuts, improvement cuts yielding 3 cords or more per acre, and one-tenth of the entire net volume of stands 10 or more years beyond the rotation age. Stands past rotation age are subject to excessive mortality or deterioration and should be harvested first to reduce loss and improve timber growth.

Species Groups Recorded During The Survey

National groups	Local groups	*Species*
Softwoods:		
White and red pine	White pine	*Pinus strobus*
	Red pine	*Pinus resinosa*
Spruce and balsam fir	Black spruce	*Picea mariana*
	White spruce	*Picea glauca*
	Balsam fir	*Abies balsamea var. balsamea*
Other softwoods	Jack pine	*Pinus banksiana*
	Tamarack	*Larix laricina*
	Cedar	*Thuja occidentalis*
		Juniperus virginiana
Hardwoods:		
Select red and white oaks	Red oak	*Quercus rubra*
		Quercus palustris
	White oak	*Quercus alba*
		Quercus macrocarpa
Yellow birch	Yellow birch	*Betula alleghaniensis*
Hard maple	Hard maple	*Acer saccharum*
		Acer nigrum
Ash, walnut, black cherry	Ash	*Fraxinus nigra*
		Fraxinus americana
		Fraxinus pennsylvanica
	Walnut	*Juglans nigra*
	Black cherry	*Prunus serotina*
Other hardwoods	Aspen	*Populus tremuloides*
		Populus grandidentata
	Balsam poplar	*Populus balsamifera*
	Basswood	*Tilia americana*
	Cottonwood	*Populus deltoides*
	Elm	*Ulmus americana*
		Ulmus rubra
		Ulmus thomassii
	Paper birch	*Betula papyrifera var. papyrifera*
		Betula nigra
	Soft maple	*Acer rubrum var. rubrum*
		Acer saccharinum
Other hardwoods		*Robinia pseudoacacia*
		Acer negundo
		Juglans cinerea
		Carya sp.
		Celtis occidentalis
		Gleditsia triacanthos
		Ostrya virginiana
		Salix nigra

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Growth and Cut Projections

50. Timber growth and cut projections, Minnesota, 1962-1992.

Table 1.--Land area by classes and Forest Survey Units, Minnesota, 1962

(In acres)

Land class	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Forest land:						
Commercial forest	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100
Unproductive forest	1,547,300	299,400	333,500	388,900	321,400	204,100
Productive-reserved forest	438,100	395,500	29,100	-	10,000	3,500
Total forest land	19,047,400	6,539,600	6,395,700	2,492,100	2,232,300	1,387,700
Nonforest land 1/	32,158,400	1,196,700	2,464,500	347,600	8,827,500	19,322,100
All land 2/	51,205,800	7,736,300	8,860,200	2,839,700	11,059,800	20,709,800

1/ Includes 668,000 acres of water according to Survey standards of area classification but defined by Bureau of the Census as land.

2/ From U. S. Bureau of the Census, Land and Water Area of the United States, 1950.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 2.--Area of commercial forest land, by ownership classes and Forest Survey Units, Minnesota, 1962

(In acres)

Ownership class	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
National Forest	2,141,400	1,570,900	569,700	800	-	-
Other Federal:						
Bureau of Land Mangt.	64,000	400	5,300	55,000	-	3,300
Indian	521,800	70,000	296,000	121,200	-	34,600
Misc. Federal	92,100	-	33,800	-	44,000	14,300
Total other Federal	677,900	70,400	335,100	176,200	44,000	52,200
State	3,303,800	849,000	1,125,600	1,104,200	22,300	202,700
County and municipal	3,416,100	1,378,600	1,588,500	292,000	113,500	43,500
Forest industry:						
Pulp and paper	630,000	314,700	119,100	196,100	-	100
Lumber	47,400	11,600	31,700	900	2,500	700
Other	37,400	19,600	7,000	10,800	-	-
Total forest industry	714,800	345,900	157,800	207,800	2,500	800
Farmer-owned	3,344,300	510,000	869,400	86,800	1,201,100	677,000
Misc. private	3,463,700	1,119,900	1,387,000	235,400	517,500	203,900
All ownerships	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 3.--Area of commercial forest land, by stand-size and ownership classes, Minnesota, 1962

(In acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
MINNESOTA					
Sawtimber	2,386,500	335,500	549,300	97,100	1,404,600
Poletimber	8,520,000	1,343,000	3,476,300	378,300	3,322,400
Sapling and seedling	4,294,500	304,000	2,246,200	205,800	1,538,500
Nonstocked	1,861,000	158,900	1,126,000	33,600	542,500
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000
LAKE SUPERIOR UNIT					
Sawtimber	627,600	243,900	194,200	47,800	141,700
Poletimber	3,097,800	959,200	1,042,100	188,500	908,000
Sapling and seedling	1,503,600	254,100	744,100	92,200	413,200
Nonstocked	615,700	113,700	317,600	17,400	167,000
All classes	5,844,700	1,570,900	2,298,000	345,900	1,629,900
CENTRAL PINE UNIT					
Sawtimber	602,900	91,600	253,300	19,400	238,600
Poletimber	3,401,100	383,400	1,565,200	84,500	1,368,000
Sapling and seedling	1,360,300	49,500	771,000	45,200	494,600
Nonstocked	668,800	45,200	459,700	8,700	155,200
All classes	6,033,100	569,700	3,049,200	157,800	2,256,400
RAINY RIVER UNIT					
Sawtimber	117,500	-	70,600	29,900	17,000
Poletimber	913,800	400	660,700	104,700	148,000
Sapling and seedling	761,900	400	563,800	65,800	131,900
Nonstocked	310,000	-	277,300	7,400	25,300
All classes	2,103,200	800	1,572,400	207,800	322,200
SOUTHEASTERN UNIT					
Sawtimber	725,900	-	14,700	-	711,200
Poletimber	673,200	-	110,800	-	562,400
Sapling and seedling	352,300	-	54,300	2,500	295,500
Nonstocked	149,500	-	-	-	149,500
All classes	1,900,900	-	179,800	2,500	1,718,600
WESTERN UNIT					
Sawtimber	312,600	-	16,500	-	296,100
Poletimber	434,100	-	97,500	600	336,000
Sapling and seedling	316,400	-	113,000	100	203,300
Nonstocked	117,000	-	71,400	100	45,500
All classes	1,180,100	-	298,400	800	880,900

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 4.--Area of commercial forest land, by forest type and Forest Survey Units, Minnesota, 1962

(In acres)

Type	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
White pine	134,500	79,400	40,000	8,600	6,300	200
Red pine	283,700	112,800	143,600	12,000	13,500	1,800
Jack pine	885,200	396,200	406,600	46,200	8,900	27,300
Balsam fir	1,173,800	711,700	269,900	181,300	5,700	5,200
White spruce	74,100	52,400	5,200	13,500	2,900	100
Black spruce	1,407,700	625,300	259,300	502,900	4,800	15,400
Tamarack	567,500	84,600	265,600	140,700	55,500	21,100
Cedar	417,300	129,200	117,000	161,700	-	9,400
Northern hdwds.	1,009,100	217,600	397,700	9,200	267,200	117,400
Oak	1,039,500	23,500	354,100	2,300	580,500	79,100
Lowland hdwds.	1,496,600	243,300	513,400	107,800	354,400	277,700
Balsam poplar	452,900	124,800	156,100	131,000	-	41,000
Aspen	5,451,000	1,950,400	2,159,800	430,300	446,700	463,800
Paper birch	803,100	477,800	276,000	45,700	-	3,600
Cottonwood	5,000	-	-	-	5,000	-
Grass and upland brush	450,500	174,700	156,000	42,400	41,600	35,800
Lowland brush	1,410,500	441,000	512,800	267,600	107,900	81,200
All types	17,062,000	5,844,700	6,033,100	2,103,200	1,900,900	1,180,100

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 5.--Area of commercial forest land, by sawtimber volume and stand-size classes, Minnesota, 1962

(In acres)

Volume per acre (board feet)[1]	All stands	Sawtimber stands	Other stands
Less than 1,500	14,675,000	792,900	13,882,100
1,500 to 5,000	1,557,000	889,400	667,600
More than 5,000	830,000	704,200	125,800
Total	17,062,000	2,386,500	14,675,500

[1] Net volume, International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 6.--Area of commercial forest land, by stocking classes based on alternative stand components, Minnesota, 1962

(In acres)

Stocking class (percent)	Stocking classified in terms of:		
	All trees	Growing stock trees	Desirable trees
90-100	5,772,200	3,048,700	1,219,500
80-90	3,561,300	2,854,000	1,942,600
70-80	837,800	585,400	237,300
60-70	2,105,900	3,043,700	2,665,600
50-60	981,400	1,192,100	645,600
40-50	1,063,700	1,508,700	2,539,600
30-40	512,700	1,178,400	1,188,100
20-30	468,900	1,048,700	1,948,200
10-20	391,100	741,300	1,123,600
Less than 10	1,367,000	1,861,000	3,551,900
Total	17,062,000	17,062,000	17,062,000

Table 7.--Area of commercial forest land, by stocking classes of growing stock trees and by stand-size classes, Minnesota, 1962

(In acres)

Stocking class (percent)	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 or more	6,488,100	829,800	3,641,300	2,017,000	-
40-70	5,744,500	988,900	3,389,400	1,366,200	-
10-40	2,968,400	567,800	1,489,300	911,300	-
Less than 10	1,861,000	-	-	-	1,861,000
All classes	17,062,000	2,386,500	8,520,000	4,294,500	1,861,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 8.--Area of commercial forest land, by area-condition and ownership classes, Minnesota, 1962

(In acres)

Area condition class	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
Desirable	4,071,700	501,500	2,194,500	315,200	1,060,500
Moderate and favorable	3,574,900	540,200	1,565,500	167,100	1,302,100
Moderate and unfavorable	2,190,300	473,600	942,800	76,600	697,300
Poor but favorable	2,137,400	253,200	471,300	41,700	1,371,200
Poor and unfavorable	5,087,700	372,900	2,223,700	114,200	2,376,900
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 9.--Area of commercial forest land, by sites and ownership classes, Minnesota, 1962

(In acres)

Site class (growth per acre per year in cu. ft.)	All ownerships	National Forest	Other public	Forest industry	Farmer and misc. private
120 or more	4,300	-	2,700	500	1,100
85-120	916,300	100,900	339,000	34,200	442,200
50-85	7,755,400	1,050,000	3,061,500	333,200	3,310,700
Less than 50	8,386,000	990,500	3,994,600	346,900	3,054,000
All classes	17,062,000	2,141,400	7,397,800	714,800	6,808,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 10.--Area of commercial forest land, by forest types and ownership classes, Minnesota, 1962

(In acres)

Forest type	All ownerships	Public ownerships	Private ownerships
White-red-jack pine	1,355,000	878,000	477,000
Spruce-fir	4,561,000	3,356,000	1,205,000
Oak-hickory	1,080,000	206,000	874,000
Elm-ash-cottonwood	2,045,000	855,000	1,190,000
Maple-beech	1,049,000	403,000	646,000
Aspen-birch	6,972,000	3,841,000	3,131,000
All types	17,062,000	9,539,000	7,523,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 11.--Area of commercial forest land, by forest types and site classes, Minnesota, 1962

(In acres)

Forest type	All sites	Site class 1/			
		Excellent	Good	Medium	Poor
White pine	134,500	-	10,100	33,000	91,400
Red pine	283,700	15,800	92,500	151,300	24,100
Jack pine	885,200	14,000	158,300	560,400	152,500
Balsam fir	1,173,800	124,200	355,900	448,200	245,500
White spruce	74,100	4,200	12,000	37,300	20,600
Black spruce	1,407,700	170,000	372,100	422,000	443,600
Tamarack	567,500	23,300	84,000	182,200	278,000
Cedar	417,300	15,900	61,100	192,300	148,000
Northern hdwds.	1,009,100	52,200	167,000	416,300	373,600
Oak	1,039,500	65,100	151,700	372,500	450,200
Lowland hdwds.	1,496,600	105,400	231,500	429,100	730,600
Balsam poplar	452,900	10,600	85,000	178,200	179,100
Aspen	5,451,000	650,100	1,591,000	1,873,500	1,336,400
Paper birch	803,100	89,900	273,800	288,300	151,100
Cottonwood	5,000	-	-	5,000	-
Grass and upland brush	450,500	2,100	63,300	189,000	196,100
Lowland brush	1,410,500	7,100	203,300	414,800	785,300
All types	17,062,000	1,349,900	3,912,600	6,193,400	5,606,100

1/ See Appendix for the range of site index for each site class in each type.

Table 12.--Area of commercial forest land, by forest types and stand-age classes, Minnesota, 1962

(In acres)

Forest type	All ages	Age class (years)									
		Less than 9	10-19	20-29	30-39	40-49	50-59	60-79	80-99	100-119	120+
White pine	134,500	2,700	4,200	3,000	4,700	3,500	11,400	50,700	26,500	5,000	22,800
Red pine	283,700	21,900	21,200	33,400	10,000	26,900	55,700	68,000	28,800	6,300	11,500
Jack pine	885,200	38,900	83,600	82,600	145,600	181,400	117,800	178,500	50,000	3,800	3,000
Balsam fir	1,173,800	75,000	82,800	147,500	210,900	274,700	203,100	169,200	10,300	300	-
White spruce	74,100	3,200	1,800	2,400	2,100	2,500	10,300	24,000	13,600	12,300	1,900
Black spruce	1,407,700	70,900	68,600	97,700	122,000	153,800	143,200	323,900	250,300	92,300	85,000
Tamarack	567,500	40,400	33,700	67,800	66,100	57,400	60,000	101,300	56,800	43,500	40,500
Cedar	417,300	19,900	16,500	11,400	13,400	22,600	47,700	84,100	78,000	57,100	66,600
Northern hdwds.	1,009,100	33,700	49,300	76,100	140,400	146,000	135,000	210,300	95,200	61,100	62,000
Oak	1,039,500	16,600	33,700	148,100	177,300	162,100	153,400	208,300	111,600	20,600	7,800
Lowland hdwds.	1,496,600	27,500	91,700	127,200	127,900	256,800	184,300	313,800	206,200	85,300	75,900
Balsam poplar	452,900	24,700	68,100	63,700	134,300	93,800	36,100	27,100	2,400	2,700	-
Aspen	5,451,000	320,600	559,000	1,004,900	1,642,400	1,202,000	409,300	260,300	51,600	900	-
Paper birch	803,100	30,300	28,600	86,400	215,900	214,500	89,500	100,100	26,800	6,200	4,800
Cottonwood	5,000	-	5,000	-	-	-	-	-	-	-	-
Grass and upland brush	450,500	426,200	-	-	5,000	5,000	5,800	5,000	3,500	-	-
Lowland brush	1,410,500	1,335,700	11,900	33,400	8,700	4,300	9,300	-	3,600	-	3,600
All types	17,062,000	2,488,200	1,159,700	1,985,600	3,026,700	2,807,300	1,671,900	2,124,600	1,015,200	397,400	385,400

Table 13.--Area of noncommercial forest land, by forest types, Minnesota, 1962

(In acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
White-red-jack pine	150,300	150,300	-
Spruce-fir	1,117,200	101,400	1,015,800
Oak-hickory	225,500	4,600	220,900
Elm-ash-cottonwood	94,700	6,900	87,800
Maple-beech	12,660	3,800	8,800
Aspen-birch	385,100	171,100	214,000
All types	1,985,400	438,100	1,547,300

Table 14.--Area of commercial forest land, by forest types, Minnesota, in 1936, 1953, and 1962

(In acres)

Forest type	1936	1953	1962
White pine	224,000	125,000	134,000
Red pine	167,000	166,000	284,000
Jack pine	1,219,000	986,000	885,000
Spruce-fir	1,053,000	1,233,000	1,248,000
Black spruce	1,475,000	1,169,000	1,408,000
Tamarack	655,000	482,000	568,000
Cedar	378,000	284,000	417,000
Northern hardwoods	886,000	846,000	1,009,000
Oak	988,000	1,182,000	1,039,000
Lowland hardwoods	607,000	1,145,000	1,502,000
Aspen-birch	6,680,000	5,997,000	6,707,000
Nonstocked	3,768,000	3,713,000	1,861,000
All types	18,100,000	17,328,000	17,062,000

Table 15.--Area of commercial forest land, by stand-size classes, Minnesota, in 1936, 1953, and 1962

(In acres)

Stand-size class	1936	1953	1962
Sawtimber	1,520,000	2,017,000	2,387,000
Poletimber	4,417,000	5,281,000	8,520,000
Sapling and seedling			
Medium to well-stocked	4,106,000	4,646,000	3,383,000
Poorly stocked	4,289,000	1,671,000	911,000
Nonstocked	3,768,000	3,713,000	1,861,000
All classes	18,100,000	17,328,000	17,062,000

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 16.--Area of commercial forest land, by forest types and area-condition classes,[1] Minnesota, 1962

(In acres)

Forest type	All area conditions	Desirable	Moderate and favorable	Moderate and unfavorable	Poor but favorable	Poor and unfavorable
White pine	134,500	45,800	36,100	21,800	9,600	21,200
Red pine	283,700	122,000	78,500	39,800	13,700	29,700
Jack pine	885,200	348,200	258,800	90,600	74,400	113,200
Balsam fir	1,173,800	398,800	329,100	173,700	90,000	182,200
White spruce	74,100	20,200	21,200	13,100	10,300	9,300
Black spruce	1,407,700	685,600	321,000	158,400	106,500	136,200
Tamarack	567,500	188,200	109,200	110,100	45,400	114,600
Cedar	417,300	153,400	110,900	63,900	37,400	51,700
Northern hdwds.	1,009,100	135,000	266,300	122,400	272,200	213,200
Oak	1,039,500	125,700	166,000	92,100	341,000	314,700
Lowland hdwds.	1,496,600	194,600	337,500	188,700	320,100	455,700
Balsam poplar	452,900	112,500	84,600	98,000	39,300	118,500
Aspen	5,451,000	1,310,300	1,225,600	897,500	690,500	1,327,100
Paper birch	803,100	231,400	230,100	120,200	42,300	179,100
Cottonwood	5,000	-	-	-	-	5,000
Grass and upland brush	450,500	-	-	-	23,000	427,500
Lowland brush	1,410,500	-	-	-	21,700	1,388,800
All types	17,062,000	4,071,700	3,574,900	2,190,300	2,137,400	5,087,700

1/ Area condition classification:
Desirable.--70 percent or more stocked with desirable trees.
Moderate and favorable.--40-to 70-percent stocked with desirable trees and less than 30 percent of the area controlled by inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.
Moderate and unfavorable.--40-to 70-percent stocked with desirable trees, more than 30 percent of the area controlled by inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.
Poor but favorable.--Less than 40-percent stocked with desirable trees and with adequate seed source and seedbed favorable to natural regeneration.
Poor and unfavorable.--Areas less than 40-percent stocked with desirable trees, inadequate seed source or seedbed unfavorable to natural regeneration.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 17.--Area of land and forest land, by counties, Minnesota, 1962

County	All land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Acres	Acres	Acres	Acres	Percent
LAKE SUPERIOR UNIT					
Carlton	550,400	383,400	16,400	367,000	67
Cook	897,900	868,900	158,900	710,000	79
Lake	1,364,500	1,306,800	202,800	1,104,000	81
Pine	903,700	515,900	56,500	459,400	51
St. Louis	4,019,800	3,464,600	260,300	3,204,300	80
Total	7,736,300	6,539,600	694,900	5,844,700	76
CENTRAL PINE UNIT					
Aitkin	1,167,400	900,400	49,800	850,600	73
Becker	841,600	390,100	4,200	385,900	46
Beltrami	1,610,900	1,178,200	185,200	993,000	62
Cass	1,313,900	1,023,800	17,400	1,006,400	77
Clearwater	643,200	394,500	26,800	367,700	57
Crow Wing	639,400	449,500	2,000	447,500	70
Hubbard	596,500	445,800	5,700	440,100	74
Itasca	1,704,300	1,480,900	69,000	1,411,900	83
Wadena	343,000	132,500	2,500	130,000	38
Total	8,860,200	6,395,700	362,600	6,033,100	68
RAINY RIVER UNIT					
Koochiching	2,002,600	1,868,700	294,000	1,574,700	79
Lake of the Woods	837,100	623,400	94,900	528,500	63
Total	2,839,700	2,492,100	388,900	2,103,200	74
SOUTHEASTERN UNIT					
Anoka	272,000	74,400	12,300	62,100	23
Benton	258,600	35,000	7,700	27,300	11
Carver	229,100	28,400	4,500	23,900	10
Chisago	268,200	66,100	13,200	52,900	20
Dakota	365,400	42,100	8,500	33,600	9
Douglas	407,700	48,200	5,900	42,300	10
Fillmore	549,800	90,100	6,400	83,700	15
Goodhue	485,100	71,100	8,100	63,000	13
Hennepin	361,600	36,800	6,200	30,600	8
Houston	361,600	127,800	13,000	114,800	32
Isanti	282,900	60,900	9,700	51,200	18
Kanabec	336,000	177,400	22,800	154,600	46
Le Sueur	282,200	31,200	1,700	29,500	10
Mille Lacs	363,500	157,500	26,200	131,300	36
Morrison	727,000	230,300	30,000	200,300	28

(Continued)

Table 17 (Cont'd)

SOUTHEASTERN UNIT

County	All land	Forest land			Commercial forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Acres	Acres	Acres	Acres	Percent
Olmstead	419,200	52,900	5,000	47,900	11
Otter Tail	1,280,000	268,200	35,900	232,300	18
Ramsey	102,400	8,700	2,100	6,600	6
Rice	316,800	25,700	2,700	23,000	7
Scott	225,300	27,000	3,400	23,600	10
Sherburne	280,300	59,100	16,800	42,300	15
Stearns	867,800	103,100	24,900	78,200	9
Todd	606,100	147,600	19,300	128,300	21
Wabasha	333,400	65,300	13,700	51,600	16
Washington	249,600	33,300	6,400	26,900	11
Winona	398,700	114,700	18,200	96,500	24
Wright	429,500	49,400	6,800	42,600	10
Total	11,059,800	2,232,300	331,400	1,900,900	17

WESTERN UNIT

Big Stone	326,400	4,000	200	3,800	1
Blue Earth	473,600	33,300	1,900	31,400	7
Brown	392,300	15,800	1,100	14,700	4
Chippewa	372,500	8,500	700	7,800	2
Clay	672,000	24,900	4,900	20,000	3
Cottonwood	409,600	7,100	400	6,700	2
Dodge	278,400	9,000	500	8,500	3
Faribault	456,300	13,600	800	12,800	3
Freeborn	449,300	16,400	1,000	15,400	3
Grant	356,500	5,400	300	5,100	1
Jackson	446,700	6,800	600	6,200	1
Kandiyohi	527,400	23,200	2,000	21,200	4
Kittson	719,400	119,700	25,500	94,200	13
Lac qui Parle	494,700	8,600	500	8,100	2
Lincoln	345,600	5,400	300	5,100	2
Lyons	456,300	6,700	800	5,900	1
Mahnomen	367,400	128,800	2,200	126,600	34
Marshall	1,152,000	203,200	51,600	151,600	13
Martin	452,500	7,200	400	6,800	2
McLeod	318,700	11,000	600	10,400	3
Meeker	396,800	16,600	900	15,700	4
Mower	449,900	9,900	500	9,400	2
Murray	453,100	5,100	500	4,600	1
Nicollet	293,800	18,200	1,100	17,100	6
Nobles	455,700	3,300	200	3,100	1
Norman	566,400	33,300	3,300	30,000	5
Pennington	398,100	44,000	8,400	35,600	9
Pipestone	297,000	1,900	100	1,800	1
Polk	1,287,700	91,800	17,300	74,500	6
Pope	435,800	18,200	1,000	17,200	4

(Continued)

Table 17 (Cont'd)

WESTERN UNIT

County	All land	Forest land: All forest	Forest land: Non-commercial	Forest land: Commercial	Commercial forest as a percent of land area
	Acres	Acres	Acres	Acres	Percent
Red Lake	276,500	43,100	6,200	36,900	13
Redwood	559,300	10,900	600	10,300	2
Renville	627,200	15,000	800	14,200	2
Rock	310,400	2,000	100	1,900	1
Roseau	1,072,600	336,600	65,600	271,000	25
Sibley	371,800	24,900	1,400	23,500	6
Steele	272,000	10,500	800	9,700	4
Stevens	364,800	2,500	100	2,400	1
Swift	478,100	8,400	600	7,800	2
Traverse	366,100	2,600	100	2,500	1
Waseca	265,600	12,300	700	11,600	4
Watonwan	277,100	5,400	300	5,100	2
Wilkin	481,300	2,100	100	2,000	-
Yellow Medicine	485,100	10,500	600	9,900	2
Total	20,709,800	1,387,700	207,600	1,180,100	6

ALL UNITS

All counties	51,205,800	19,047,400	1,985,400	17,062,000	33

Table 18.--Number of growing stock trees on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand trees)

Species	All diameters	Diameter class (inches at breast height) 3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 & larger
twoods:												
hite pine	28,567	5,113	6,897	5,986	3,828	2,655	1,366	1,172	849	664	37	-
ed pine	63,149	17,098	15,036	9,952	8,885	5,697	3,832	1,628	817	299	2	3
Jack pine	336,368	108,397	114,197	64,709	33,937	11,195	3,055	788	81	9	-	
alsam fir	679,157	426,933	178,451	55,629	13,452	3,655	741	245	50	1	-	
hite spruce	46,081	18,088	13,433	6,035	3,467	2,462	932	1,021	448	195	-	-
lack spruce	830,776	530,163	228,728	60,108	9,756	1,477	369	145	17	13	-	-
amarack	239,152	99,363	107,774	25,647	5,092	883	278	101	14	-	-	-
edar	216,924	115,232	63,259	25,365	8,261	3,381	904	342	136	44	-	-
Total softwoods	2,440,174	1,320,387	727,775	253,431	86,578	31,405	11,477	5,442	2,412	1,225	39	3
dwoods:												
ard maple	80,187	45,562	17,296	6,762	3,910	3,809	1,528	995	150	174	1	-
ellow birch	3,313	249	1,091	198	211	330	403	388	295	148	-	-
asswood	130,921	60,715	36,604	15,120	8,321	5,644	2,691	1,742	621	463	-	-
alsam poplar	144,552	58,688	50,164	19,665	9,781	4,213	1,555	269	160	56	1	-
lm	136,986	71,779	25,306	15,846	9,829	5,781	4,033	1,820	1,113	1,457	20	2
ed oak	134,564	47,700	41,783	22,579	11,663	5,467	2,636	1,365	838	515	18	-
hite oak	98,700	46,146	23,466	13,128	8,361	3,268	2,281	760	602	678	10	-
spen	1,456,588	613,918	514,431	211,752	79,802	25,612	8,049	2,494	376	154	-	-
ottonwood	1,820	1,022	14	201	369	-	100	-	54	60	-	-
aper birch	662,864	398,366	187,981	51,825	16,608	5,509	1,317	957	182	119	-	-
oft maple	77,261	54,308	13,059	4,739	2,756	801	885	349	246	118	-	-
sh	248,022	139,245	63,358	25,533	11,040	5,771	1,631	574	606	264	-	-
ther hardwoods	68,815	46,565	15,234	4,279	1,371	902	283	90	69	22	-	-
Total hardwoods	3,244,593	1,584,263	988,787	391,627	164,022	67,107	27,392	11,803	5,312	4,228	50	2
species	5,684,767	2,904,650	1,716,562	645,058	250,600	98,512	38,869	17,245	7,724	5,453	89	5

Table 19.--Number of cull and salvable dead trees on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand trees)

Diameter class (inches)	Cull trees	Salvable dead trees
Softwoods:		
5.0 - 8.9	9,265	1,814
9.0 - 18.9	2,037	233
19.0 and larger	-	*
Total	11,302	2,047
Hardwoods:		
5.0 - 10.9	92,731	846
11.0 - 18.9	23,631	35
19.0 and larger	3,029	1
Total	119,391	882
All species	130,693	2,929

* Less than 500 trees.

Table 20.--Volume of timber on commercial forest land, by tree and species classes, Minnesota, 1962

(In thousand cubic feet)

Tree class	All species	Softwoods	Hardwoods
Growing stock:			
Sawtimber			
Saw log portion	2,412,036	1,050,016	1,362,020
Upper stem portion	409,006	261,732	147,274
Total sawtimber	2,821,042	1,311,748	1,509,294
Poletimber	6,980,764	2,295,518	4,685,246
Total growing stock	9,801,806	3,607,266	6,194,540
Sound cull:			
Sawtimber	110,000	18,000	92,000
Poletimber	78,000	8,000	70,000
Total sound cull	188,000	26,000	162,000
Rotten cull:			
Sawtimber	173,000	25,000	148,000
Poletimber	163,000	26,000	137,000
Total rotten cull	336,000	51,000	285,000
Salvable dead:			
Sawtimber	1,063	955	108
Poletimber	9,975	7,437	2,538
Total salvable dead	11,038	8,392	2,646
All classes[1/]	10,336,844	3,692,658	6,644,186

[1/] Estimates of additional volumes on unproductive forest land total 12,224 thousand cubic feet in trees 5.0 inches and larger d.b.h., including 8,019 thousand cubic feet of softwoods and 4,205 thousand cubic feet of hardwoods.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 21.--Volume of growing stock and sawtimber on commercial forest land, by ownership and species classes, Minnesota, 1962

GROWING STOCK
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National Forest	1,713,423	905,411	808,012
Other public	4,106,633	1,723,732	2,382,901
Forest industry	579,070	283,800	295,270
Farmer and misc. private	3,402,680	694,323	2,708,357
All ownerships	9,801,806	3,607,266	6,194,540

SAWTIMBER
(In thousand board feet)[1/]

Ownership class	All species	Softwoods	Hardwoods
National Forest	1,840,990	1,233,300	607,690
Other public	6,099,700	3,266,210	2,833,490
Forest industry	916,310	531,310	385,000
Farmer and misc. private	6,661,270	1,528,710	5,132,560
All ownerships	15,518,270	6,559,530	8,958,740

[1/] International 1/4-inch rule.

Table 22.--Volume of growing stock and sawtimber on commercia forest land, by stand-size and species classes, Minnesota, 1962

GROWING STOCK
(In thousand cubic feet)

Stand-size class	All species	Softwoods	Hardwoods
Sawtimber	2,256,990	837,558	1,419,432
Poletimber	6,893,777	2,424,573	4,469,204
Sapling and seedling	626,438	335,062	291,376
Nonstocked	24,601	10,073	14,528
All classes	9,801,806	3,607,266	6,194,540

SAWTIMBER
(In thousand board feet)[1/]

Stand-size class	All species	Softwoods	Hardwoods
Sawtimber	9,068,760	3,504,960	5,563,800
Poletimber	5,865,740	2,756,890	3,108,850
Sapling and seedling	550,440	285,150	265,290
Nonstocked	33,330	12,530	20,800
All classes	15,518,270	6,559,530	8,958,740

[1/] International 1/4-inch rule.

Table 23.--Volume of growing stock on commercial forest land, by species and diameter class, Minnesota, 1962

(In thousand cubic feet)

Species	Diameter class (inches at breast height)										
	All diameters	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 & larger
oftwoods:											
White pine	203,875	12,648	23,163	22,957	30,596	20,927	26,157	23,100	36,838	7,489	-
Red pine	345,483	28,124	47,905	57,117	71,526	61,470	33,970	23,874	20,864	356	277
Jack pine	815,564	210,669	259,254	181,447	105,662	38,837	16,780	2,512	403	-	-
Balsam fir	715,772	322,209	239,117	91,506	42,076	12,119	8,406	300	39	-	-
White spruce	181,178	22,910	24,119	38,275	30,921	18,027	27,002	12,087	7,837	-	-
Black spruce	763,709	407,379	268,829	60,309	16,590	6,059	3,208	672	663	-	-
Tamarack	318,631	154,943	109,763	35,392	7,355	7,892	2,994	292	-	-	-
Cedar	263,054	90,392	74,094	47,242	28,630	11,755	6,027	3,405	1,509	-	-
Total softwoods	3,607,266	1,249,274	1,046,244	534,245	333,356	177,086	124,544	66,242	68,153	7,845	277
rdwoods:											
Hard maple	137,855	21,425	21,014	20,501	31,687	18,620	14,315	3,752	6,138	403	-
Yellow birch	17,341	1,454	916	1,098	1,770	3,697	3,231	2,086	3,057	32	-
Basswood	347,197	56,272	57,852	59,376	62,292	45,717	34,728	16,250	14,710	-	-
Balsam poplar	371,924	113,523	98,781	76,235	40,914	26,331	7,695	6,036	2,180	229	-
Elm	384,114	39,074	59,938	56,777	55,948	56,208	33,022	27,105	53,823	1,477	742
Red oak	373,583	73,707	86,363	72,798	50,615	33,694	21,812	18,328	15,705	561	-
White oak	204,871	37,186	41,309	39,176	25,027	23,526	13,469	10,847	13,730	601	-
Aspen	3,018,171	1,003,774	976,677	605,085	245,666	120,420	43,734	14,141	8,643	31	-
Cottonwood	6,834	-	996	1,003	-	1,114	-	1,612	2,109	-	-
Paper birch	768,488	344,582	211,870	118,729	51,018	17,807	16,219	5,593	2,670	-	-
Soft maple	96,522	19,362	17,862	16,764	9,504	14,836	5,917	6,786	5,491	-	-
Ash	418,131	117,180	103,040	80,067	58,689	23,510	13,580	12,063	10,002	-	-
Other hardwoods	49,509	17,996	8,034	7,450	8,848	2,639	2,188	1,161	1,193	-	-
Total hardwoods	6,194,540	1,845,535	1,684,652	1,155,059	641,978	388,119	209,910	125,760	139,451	3,334	742
l species	9,801,806	3,094,809	2,730,896	1,689,304	975,334	565,205	334,454	192,002	207,604	11,179	1,019

Table 24.--Volume of sawtimber on commercial forest land, by species and diameter classes, Minnesota, 1962

(In thousand board feet)[1]

Species	All diameters	9.0-10.9[2]	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-28.9	29.0-38.9	39.0 & larger
	Diameter class (inches at breast height)								
Softwoods:									
White pine	956,750	113,690	149,070	127,820	158,910	135,530	233,550	38,180	-
Red pine	1,625,190	328,850	403,630	402,580	217,850	159,290	109,540	2,240	1,210
Jack pine	1,560,200	744,110	499,710	196,770	107,060	10,760	1,790	-	-
Balsam fir	740,260	447,160	205,100	54,610	29,820	3,540	30	-	-
White spruce	651,730	167,740	132,850	82,520	134,630	80,850	53,140	-	-
Black spruce	335,380	230,330	56,880	26,130	16,380	3,000	2,660	-	-
Tamarack	296,450	215,240	48,910	23,610	7,190	1,500	-	-	-
Cedar	393,570	195,680	110,720	46,000	21,590	14,200	5,380	-	-
Total sftwds.	6,559,530	2,442,800	1,606,870	960,040	693,430	408,670	406,090	40,420	1,210
Hardwoods:									
Hard maple	465,630	-	180,990	119,130	98,260	24,290	40,970	1,990	-
Yellow birch	79,620	-	9,500	20,080	20,660	10,370	18,910	100	-
Basswood	1,040,140	-	354,380	276,530	219,290	93,650	96,290	-	-
Balsam poplar	530,860	-	268,240	172,850	43,830	31,840	13,220	880	-
Elm	1,413,890	-	324,400	347,120	209,540	174,980	340,750	11,640	5,460
Red oak	885,400	-	298,570	210,390	155,190	120,180	96,130	4,940	-
White oak	600,710	-	151,130	142,630	77,400	69,430	156,940	3,180	-
Aspen	2,387,860	-	1,314,800	680,620	272,620	69,620	50,200	-	-
Cottonwood	39,110	-	-	10,550	-	13,570	14,990	-	-
Paper birch	448,280	-	240,640	90,910	74,080	28,650	14,000	-	-
Soft maple	238,050	-	49,660	77,940	37,060	37,680	35,710	-	-
Ash	743,830	-	365,700	143,560	70,230	98,530	65,810	-	-
Other hardwoods	85,360	-	43,300	16,340	14,690	5,350	5,680	-	-
Total hdwds.	8,958,740	-	3,601,310	2,308,650	1,292,850	778,140	949,600	22,730	5,460
All species	15,518,270	2,442,800	5,208,180	3,268,690	1,986,280	1,186,810	1,355,690	63,150	6,670

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[1] International 1/4-inch rule.
[2] Softwood only.

Table 25.--Volume of growing stock on commercial forest land, by species and Forest Survey Unit, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	203,875	99,777	78,297	23,037	2,559	205
Red pine	345,483	122,656	195,296	17,230	1,580	8,721
Jack pine	815,564	463,643	295,215	35,384	8,603	12,719
Balsam fir	715,772	357,467	199,040	147,936	-	11,329
White spruce	181,178	113,791	32,343	33,701	893	450
Black spruce	763,709	318,054	114,779	321,925	284	8,667
Tamarack	318,631	74,758	134,316	81,859	19,632	8,066
Cedar	263,054	94,097	63,539	99,580	-	5,838
Total softwoods	3,607,266	1,644,243	1,112,825	760,652	33,551	55,995
Hardwoods:						
Hard maple	137,855	26,536	82,445	1,138	22,096	5,640
Yellow birch	17,341	11,755	5,443	-	143	-
Basswood	347,197	30,233	155,922	20,422	88,820	51,800
Balsam poplar	371,924	117,212	119,480	92,628	3,950	38,654
Elm	384,114	31,711	138,471	35,202	91,948	86,782
Red oak	373,583	12,126	176,352	158	166,445	18,502
White oak	204,871	3,587	79,521	3,950	81,252	36,561
Aspen	3,018,171	1,125,545	1,318,399	335,355	113,080	125,792
Cottonwood	6,834	-	-	-	4,353	2,481
Paper birch	768,488	398,468	280,142	52,179	28,551	9,148
Soft maple	96,522	23,684	34,318	1,288	19,449	17,783
Ash	418,131	112,370	153,126	43,315	61,059	48,261
Other hardwoods	49,509	1,272	5,672	205	35,076	7,284
Total hardwoods	6,194,540	1,894,499	2,549,291	585,840	716,222	448,688
All species	9,801,806	3,538,742	3,662,116	1,346,492	749,773	504,683

Table 26.--Volume of sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	956,750	379,180	454,140	106,330	15,620	1,480
Red pine	1,625,190	455,360	1,034,440	72,760	-	62,630
Jack pine	1,560,200	787,430	655,740	39,260	38,700	39,070
Balsam fir	740,260	284,060	295,780	147,290	-	13,130
White spruce	651,730	333,510	187,980	122,360	4,860	3,020
Black spruce	335,380	186,850	26,700	119,260	-	2,570
Tamarack	296,450	30,300	125,550	111,660	14,510	14,430
Cedar	393,570	130,770	98,110	161,880	-	2,810
Total sftwds.	6,559,530	2,587,460	2,878,440	880,800	73,690	139,140
Hardwoods:						
Hard maple	465,630	54,780	277,350	1,220	99,120	33,160
Yellow birch	79,620	57,130	21,140	-	1,350	-
Basswood	1,040,140	92,120	365,470	64,650	319,260	198,640
Balsam poplar	530,860	178,260	199,510	105,710	13,110	34,270
Elm	1,413,890	157,440	396,590	96,520	430,010	333,330
Red oak	885,400	20,270	252,410	-	572,540	40,180
White oak	600,710	5,200	202,850	5,440	266,890	120,330
Aspen	2,387,860	884,240	1,021,780	288,750	104,310	88,780
Cottonwood	39,110	-	-	-	28,980	10,130
Paper birch	448,280	189,130	174,840	62,520	16,040	5,750
Soft maple	238,050	6,930	60,830	1,300	86,230	82,760
Ash	743,830	185,150	184,460	39,530	110,970	223,720
Other hdwds.	85,360	-	-	-	67,770	17,590
Total hdwds.	8,958,740	1,830,650	3,157,230	665,640	2,116,580	1,188,640
All species	15,518,270	4,418,110	6,035,670	1,546,440	2,190,270	1,327,780

[1] International 1/4-inch rule.

Table 27.--Volume of sawtimber on commercial forest land, by species and log grades, Minnesota, 1962

(In thousand board feet)[1]

Species	Log grades				
	All grades	Grade 1	Grade 2	Grade 3	Tie and timber
Softwoods:					
White and red pine	2,581,940	18,330	534,490	2,029,120	-
Spruce and balsam fir	1,727,370	-	10,270	1,717,100	-
Other softwoods	2,250,220	3,080	43,930	2,203,210	-
Total softwoods	6,559,530	21,410	588,690	5,949,430	-
Hardwoods:					
Select white and red oaks	1,486,110	26,160	120,480	727,450	612,020
Other white and red oaks	-	-	-	-	-
Yellow birch	79,620	16,860	28,600	32,810	1,350
Hard maple	465,630	14,070	33,340	73,700	344,520
Ash, walnut and black cherry	756,830	48,480	104,600	349,900	253,850
Other hardwoods	6,170,550	466,500	1,080,940	2,791,910	1,831,200
Total hardwoods	8,958,740	572,070	1,367,960	3,975,770	3,042,940
All species	15,518,270	593,480	1,956,650	9,925,200	3,042,940

[1] International 1/4-inch rule.

Table 28.--Volume of salvable dead sawtimber-size trees on commercial forest land, by species, Minnesota, 1953 and 1962

(In thousand board feet)[1]

Species group	Volume
Softwoods	9,786
Hardwoods	1,800
All species	11,586

[1] International 1/4-inch log rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 29.--Volume of growing stock on commercial forest land, by species, Minnesota, 1953 and 1962

(In thousand cubic feet)

Species	1953	1962
Softwoods:		
White pine	220,000	203,875
Red pine	235,000	345,483
Jack pine	771,000	815,564
Balsam fir	441,000	715,772
White spruce	152,000	181,178
Black spruce	579,000	763,709
Tamarack	218,000	318,631
Cedar	213,000	263,054
Total softwoods	2,829,000	3,607,266
Hardwoods:		
Hard maple	124,000	137,855
Yellow birch	15,000	17,341
Basswood	297,000	347,197
Balsam poplar	154,000	371,924
Elm	353,000	384,114
Red oak	484,000	373,583
White oak	286,000	204,871
Aspen	1,812,000	3,018,171
Cottonwood	50,000	6,834
Paper birch	416,000	768,488
Soft maple	45,000	96,522
Ash	306,000	418,131
Other hardwoods	64,000	49,509
Total hardwoods	4,406,000	6,194,540
All species	7,235,000	9,801,806

Table 30.--Volume of sawtimber on commercial fore land, by species, Minnesota, 1953 and 1

(In thousand board feet)[1]

Species	1953	1962
Softwoods:		
White pine	868,000	956,75
Red pine	850,000	1,625,19
Jack pine	1,420,000	1,560,20
Balsam fir	504,000	740,26
White spruce	473,000	651,73
Black spruce	363,000	335,38
Tamarack	166,000	296,45
Cedar	395,000	393,57
Total softwoods	5,039,000	6,559,53
Hardwoods:		
Hard maple	261,000	465,63
Yellow birch	53,000	79,62
Basswood	833,000	1,040,14
Balsam poplar	225,000	530,86
Elm	1,167,000	1,413,89
Red oak	1,218,000	885,40
White oak	714,000	600,71
Aspen	1,716,000	2,387,86
Cottonwood	211,000	39,11
Paper birch	405,000	448,28
Soft maple	104,000	238,05
Ash	462,000	743,83
Other hardwoods	130,000	85,36
Total hardwoods	7,499,000	8,958,74
All species	12,538,000	15,518,27

[1] International 1/4-inch rule.

Table 31.--Volume of growing stock and sawtimber on commercial forest land, by counties and species classes, Minnesota, 1962

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
LAKE SUPERIOR UNIT						
Carlton	112,204	28,764	83,440	118,770	40,110	78,660
Cook	563,452	305,359	258,093	839,720	511,060	328,660
Lake	758,139	380,243	377,896	899,480	476,280	423,200
Pine	117,015	11,447	105,568	174,510	25,470	149,040
St. Louis	1,987,932	918,430	1,069,502	2,385,630	1,534,540	851,090
Total	3,538,742	1,644,243	1,894,499	4,418,110	2,587,460	1,830,650
CENTRAL PINE UNIT						
Aitkin	437,802	94,974	342,828	827,980	176,230	651,750
Becker	247,807	49,928	197,879	395,890	155,200	240,690
Beltrami	479,245	165,039	314,206	685,140	254,920	430,220
Cass	588,131	192,491	395,640	772,250	466,190	306,060
Clearwater	218,080	33,038	185,042	332,370	106,300	226,070
Crow Wing	323,979	73,193	250,786	438,390	187,250	251,140
Hubbard	240,192	82,713	157,479	275,100	182,090	93,010
Itasca	1,086,416	396,477	689,939	2,252,740	1,313,820	938,920
Wadena	40,464	24,972	15,492	55,810	36,440	19,370
Total	3,662,116	1,112,825	2,549,291	6,035,670	2,878,440	3,157,230
RAINY RIVER UNIT						
Koochiching	1,127,409	625,996	501,413	1,307,040	729,670	577,370
Lake of the Woods	219,083	134,656	84,427	239,400	151,130	88,270
Total	1,346,492	760,652	585,840	1,546,440	880,800	665,640
SOUTHEASTERN UNIT						
Anoka	22,854	3,934	18,920	48,140	3,450	44,690
Benton	10,041	205	9,836	30,350	40	30,310
Carver	10,910	87	10,823	45,110	-	45,110
Chisago	19,426	1,446	17,980	67,800	1,370	66,430
Dakota	11,929	166	11,763	44,670	-	44,670
Douglas	16,756	213	16,543	58,050	-	58,050
Fillmore	44,192	300	43,892	173,860	40	173,820
Goodhue	33,283	205	33,078	134,400	-	134,400
Hennepin	12,569	103	12,466	56,590	40	56,550
Houston	59,779	356	59,423	240,860	80	240,780
Isanti	18,170	1,288	16,882	54,130	1,100	53,030
Kanabec	48,901	916	47,985	37,960	1,680	36,280
Le Sueur	15,271	40	15,231	70,290	-	70,290
Mille Lacs	43,545	2,694	40,851	61,450	5,440	56,010
Morrison	58,950	7,181	51,769	102,030	27,450	74,580

(Continued)

Table 31 (Cont'd)

SOUTHEASTERN UNIT

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Olmsted	25,059	103	24,956	96,600	-	96,600
Otter Tail	81,299	7,702	73,597	125,170	16,150	109,020
Ramsey	1,501	-	1,501	11,610	-	11,610
Rice	9,741	-	9,741	44,360	-	44,360
Scott	10,152	40	10,112	43,310	-	43,310
Sherburne	12,845	782	12,063	40,890	590	40,300
Stearns	30,288	395	29,893	105,010	270	104,740
Todd	47,913	4,306	43,607	81,730	15,950	65,780
Wabasha	24,506	213	24,293	95,270	-	95,270
Washington	12,048	142	11,906	47,600	40	47,560
Winona	47,463	616	46,847	181,590	-	181,590
Wright	20,382	118	20,264	91,440	-	91,440
Total	749,773	33,551	716,222	2,190,270	73,690	2,116,580

WESTERN UNIT

County	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
Big Stone	2,323	24	2,299	5,770	-	5,770
Blue Earth	19,315	150	19,165	99,540	-	99,540
Brown	9,085	118	8,967	39,280	-	39,280
Chippewa	2,433	32	2,401	10,980	-	10,980
Clay	4,740	-	4,740	14,320	-	14,320
Cottonwood	5,546	24	5,522	28,110	-	28,110
Dodge	6,257	39	6,218	24,120	-	24,120
Faribault	6,525	63	6,462	32,750	-	32,750
Freeborn	10,065	79	9,986	38,340	-	38,340
Grant	3,271	47	3,224	14,170	-	14,170
Jackson	4,432	32	4,400	23,380	-	23,380
Kandiyohi	11,818	95	11,723	46,370	-	46,370
Kittson	18,786	-	18,786	13,960	-	13,960
Lac qui Parle	3,294	32	3,262	16,180	-	16,180
Lincoln	1,762	24	1,738	7,500	-	7,500
Lyon	3,879	32	3,847	20,080	-	20,080
Mahnomen	93,560	7,078	86,482	106,910	26,710	80,200
Marshall	28,716	2,330	26,386	26,660	5,700	20,960
Martin	2,481	32	2,449	11,120	-	11,120
McLeod	7,655	47	7,608	38,760	-	38,760
Meeker	12,189	103	12,086	57,600	-	57,600
Mower	6,731	63	6,668	30,240	-	30,240
Murray	2,733	39	2,694	11,970	-	11,970
Nicollet	8,666	79	8,587	38,870	-	38,870
Nobles	1,153	24	1,129	5,260	-	5,260

(Continued)

Table 31 (cont'd)

WESTERN UNIT

County	Growing stock			Sawtimber		
	All growing stock	Softwoods	Hardwoods	All sawtimber	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
Norman	8,414	-	8,414	23,670	-	23,670
Pennington	7,363	-	7,363	10,010	-	10,010
Pipestone	1,375	16	1,359	5,300	-	5,300
Polk	17,079	608	16,471	23,390	1,500	21,890
Pope	9,180	71	9,109	35,000	-	35,000
Red Lake	10,499	-	10,499	14,430	-	14,430
Redwood	5,791	47	5,744	23,260	-	23,260
Renville	10,033	79	9,954	43,670	-	43,670
Rock	1,035	24	1,011	4,170	-	4,170
Roseau	114,408	44,256	70,152	180,850	105,230	75,620
Sibley	16,108	111	15,997	78,480	-	78,480
Steele	5,222	47	5,175	24,020	-	24,020
Stevens	1,738	-	1,738	10,840	-	10,840
Swift	4,614	39	4,575	22,480	-	22,480
Traverse	308	8	300	1,690	-	1,690
Waseca	5,728	32	5,696	22,570	-	22,570
Watonwan	2,030	24	2,006	9,220	-	9,220
Wilkin	1,706	-	1,706	9,940	-	9,940
Yellow Medicine	4,637	47	4,590	22,550	-	22,550
Total	504,683	55,995	448,688	1,327,780	139,140	1,188,640

ALL UNITS

All counties	9,801,806	3,607,266	6,194,540	15,518,270	6,559,530	8,958,740

Table 32.--Net annual growth of growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	2,986	1,566	893	388	133	6
Red pine	17,684	5,370	11,040	743	140	391
Jack pine	28,453	10,136	14,829	1,966	353	1,169
Balsam fir	13,108	10,168	192	2,750	-	-2
White spruce	7,932	4,115	1,967	1,736	30	84
Black spruce	16,747	6,383	288	9,891	6	179
Tamarack	6,341	752	2,353	2,236	829	171
Cedar	7,342	1,522	3,480	2,229	-	111
Total softwoods	100,593	40,012	35,042	21,939	1,491	2,109
Hardwoods:						
Hard maple	2,985	680	1,094	17	990	204
Yellow birch	-20	24	-52	-	8	-
Basswood	14,703	339	7,285	287	4,952	1,840
Balsam poplar	14,481	4,019	2,780	2,872	2,570	2,240
Elm	7,245	-175	759	453	3,492	2,716
Red oak	13,763	554	8,738	11	4,078	382
White oak	7,296	207	2,050	43	3,511	1,485
Aspen	173,241	68,507	60,144	19,308	11,570	13,712
Cottonwood	66	-	-	-	28	38
Paper birch	27,981	11,442	13,127	1,085	2,038	289
Soft maple	3,248	1,237	727	32	822	430
Ash	10,783	1,311	1,690	916	4,824	2,042
Other hardwoods	3,844	75	435	8	3,121	205
Total hardwoods	279,616	88,220	98,777	25,032	42,004	25,583
All species	380,209	128,232	133,819	46,971	43,495	27,692

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 33.--Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	13,860	6,330	5,630	1,500	390	10
Red pine	102,460	23,000	73,810	3,120	-	2,530
Jack pine	79,840	25,660	40,520	4,480	4,200	4,980
Balsam fir	21,470	9,240	10,950	1,430	-	-150
White spruce	36,270	19,800	13,150	2,960	240	120
Black spruce	20,820	6,870	3,590	10,290	-	70
Tamarack	15,680	830	8,470	4,540	1,020	820
Cedar	18,170	3,330	12,700	1,840	-	300
Total softwoods	308,570	95,060	168,820	30,160	5,850	8,680
Hardwoods:						
Hard maple	11,140	1,890	6,940	100	1,660	550
Yellow birch	250	400	-160	-	10	-
Basswood	40,600	190	27,220	220	8,110	4,860
Balsam poplar	33,190	11,050	11,330	4,510	530	5,770
Elm	31,550	-1,970	10,230	330	12,940	10,020
Red oak	57,530	2,660	35,260	-	16,930	2,680
White oak	15,160	170	5,100	-	4,750	5,140
Aspen	273,210	99,670	136,770	9,460	17,280	10,030
Cottonwood	670	-	-	-	110	560
Paper birch	26,370	10,240	13,490	520	1,960	160
Soft maple	4,170	10	370	100	1,540	2,150
Ash	25,680	3,050	9,300	1,390	4,440	7,500
Other hardwoods	1,420	-	-	-	1,160	260
Total hardwoods	520,940	127,360	255,850	16,630	71,420	49,680
All species	829,510	222,420	424,670	46,790	77,270	58,360

[1] International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 34.—Annual mortality of growing stock and sawtimber on commercial forest land, by species, Minnesota, 1962

Species	Growing stock	Sawtimber
	Thousand cu. ft.	Thousand bd. ft. 1/
Softwoods:		
White pine	1,509	5,165
Red pine	3,267	13,396
Jack pine	11,297	19,421
Balsam fir	20,402	31,716
White spruce	2,168	6,035
Black spruce	11,112	5,655
Tamarack	4,351	2,069
Cedar	2,296	3,100
Total softwoods	56,402	86,557
Hardwoods:		
Hard maple	233	678
Yellow birch	324	1,639
Basswood	312	1,043
Balsam poplar	1,226	1,375
Elm	2,857	7,830
Red oak	623	1,494
White oak	780	2,055
Aspen	40,335	29,717
Cottonwood	25	96
Paper birch	4,024	1,870
Soft maple	277	871
Ash	4,218	3,505
Other hardwoods	322	287
Total hardwoods	55,556	52,460
All species	111,958	139,017

1/ International 1/4-inch rule.
NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 35.--Annual mortality of growing stock and sawtimber commercial forest land, by ownership and species classes, Minnesota, 1962

GROWING STOCK

(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoo
National Forest	21,403	14,156	7,24
Other public	48,323	26,952	21,37
Forest industry	7,081	4,437	2,6
Farmer and misc. private	35,151	10,857	24,2
All ownerships	111,958	56,402	55,5

SAWTIMBER

(In thousand board feet)1/

Ownership class	All species	Softwoods	Hardwoo
National Forest	19,832	16,274	3,5
Other public	59,691	43,100	16,5
Forest industry	9,273	7,011	2,2
Farmer and misc. private	50,221	20,172	30,0
All ownerships	139,017	86,557	52,4

1/ International 1/4-inch rule.
NOTE: Refinements in computing and additional data hav made some of these statistics different from those report in "Timber Trends in the U.S.", Forest Resource Report No published by the Forest Service, U.S. Dept. Agr., in 1965

Table 36.--Annual mortality of growing stock and sawtimber on commercial forest land, by causes and species classes, Minnesota, 1962

GROWING STOCK

(In thousand cubic feet)

Cause of death	All species	Softwoods	Hardwoods
Fire	11,912	10,827	1,085
Insects	6,193	6,061	132
Disease	40,557	10,244	30,313
Other	49,505	28,749	20,756
Unknown	3,791	521	3,270
All causes	111,958	56,402	55,556

SAWTIMBER

(Thousand board feet)[1/]

Cause of death	All species	Softwoods	Hardwoods
Fire	144	-	144
Insects	13,382	12,951	431
Disease	50,012	17,335	32,677
Other	68,570	51,804	16,766
Unknown	6,909	4,467	2,442
All causes	139,017	86,557	52,460

[1/] International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 37.--Annual timber cut from growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1960

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	3,274	1,380	1,166	545	173	10
Red pine	2,851	787	1,850	120	90	4
Jack pine	21,848	11,493	8,009	1,185	248	913
Balsam fir	10,663	4,539	3,653	2,315	25	131
Spruce	19,332	10,871	3,177	5,075	55	154
Tamarack	2,637	589	1,270	315	413	50
Cedar	1,913	541	491	810	*	71
Total softwoods	62,518	30,200	19,616	10,365	1,004	1,333
Hardwoods:						
Hard maple	672	87	147	-	389	49
Yellow birch	444	345	83	10	4	2
Basswood	2,057	44	371	15	1,433	194
Balsam poplar	865	79	126	660	-	-
Elm	2,514	49	256	10	1,796	403
Red oak	5,166	156	910	-	3,750	350
White oak	3,607	9	432	10	2,627	529
Aspen	41,620	14,613	17,426	6,435	1,175	1,971
Cottonwood	1,155	-	-	-	397	758
Paper birch	2,460	851	1,337	100	132	40
Soft maple	452	5	53	-	344	50
Ash	1,513	141	534	85	571	182
Walnut	66	-	-	-	30	36
Other	536	*	*	*	229	307
Total hardwoods	63,127	16,379	21,675	7,325	12,877	4,871
All species	125,645	46,579	41,291	17,690	13,881	6,204

* Less than 500 cubic feet.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 38.--Annual timber cut from live sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1960

(In thousand board feet)[1]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	19,880	8,350	7,120	3,290	1,050	70
Red pine	14,600	4,150	9,300	640	490	20
Jack pine	53,100	23,660	23,050	2,760	740	2,890
Balsam fir	18,720	7,940	6,720	3,780	70	210
Spruce	44,450	24,650	7,310	11,770	230	490
Tamarack	5,570	1,280	2,740	760	600	190
Cedar	3,830	1,950	640	1,140	*	100
Total softwoods	160,150	71,980	56,880	24,140	3,180	3,970
Hardwoods:						
Hard maple	1,860	210	260	*	1,240	150
Yellow birch	1,900	1,390	400	70	20	20
Basswood	11,020	270	2,230	110	7,550	860
Balsam poplar	1,510	100	580	830	-	-
Elm	10,570	310	1,060	80	7,450	1,670
Red oak	18,260	430	2,190	*	14,500	1,140
White oak	10,710	20	1,000	40	7,680	1,970
Aspen	82,120	28,180	36,700	10,560	3,050	3,630
Cottonwood	5,930	-	-	-	2,340	3,590
Paper birch	7,810	3,650	3,430	410	210	110
Soft maple	2,160	30	160	*	1,800	170
Ash	5,140	510	1,980	360	1,810	480
Walnut	260	-	-	-	180	80
Other	980	*	*	*	530	450
Total hardwoods	160,230	35,100	49,990	12,460	48,360	14,320
All species	320,380	107,080	106,870	36,600	51,540	18,290

[1] International 1/4-inch rule.

* Less than 5,000 board feet.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 39.--Total output of timber products, by type of material used and species classes, Minnesota, 1960

Product and species class	Total output in standard units		Output from roundwood				Output from plant by-products (std.units)
			From growing stock		From nongrowing stock		
	Unit	Number	Std.units	M cu.ft.	Std.units	M cu.ft.	
Saw logs and bolts:							
Softwood	M bd. ft.[1]	76,130	69,430	11,253	6,700	1,082	-
Hardwood	M bd. ft.[1]	91,980	77,780	12,681	14,200	2,315	-
Total	M bd. ft.[1]	168,110	147,210	23,934	20,900	3,397	-
Veneer logs and bolts:							
Softwood	M bd. ft.[1]	-	-	-	-	-	-
Hardwood	M bd. ft.[1]	9,940	9,930	1,407	10	2	-
Total	M bd. ft.[1]	9,940	9,930	1,407	10	2	-
Cooperage logs and bolts:							
Softwood	M bd. ft.[1]	-	-	-	-	-	-
Hardwood	M bd. ft.[1]	3,060	2,620	366	440	61	-
Total	M bd. ft.[1]	3,060	2,620	366	440	61	-
Pulpwood:							
Softwood	M cords[2]	645	575	45,917	70	5,540	-
Hardwood	M cords[2]	403	360	28,360	43	3,369	-
Total	M cords[2]	1,048	935	74,277	113	8,909	-
Piling:							
Softwood	M linear ft.	159	159	105	-	-	-
Hardwood	M linear ft.	-	-	-	-	-	-
Total	M linear ft.	159	159	105	-	-	-
Poles:							
Softwood	M pieces	231	218	1,254	13	75	-
Hardwood	M pieces	-	-	-	-	-	-
Total	M pieces	231	218	1,254	13	75	-
Mine timbers (round):							
Softwood	M cu. ft.	469	388	388	81	81	-
Hardwood	M cu. ft.	112	93	93	19	19	-
Total	M cu. ft.	581	481	481	100	100	-
Miscellaneous industrial wood:[3]							
Softwood	M cu. ft.	145	145	145	-	-	-
Hardwood	M cu. ft.	2,115	1,815	1,815	173	173	127
Total	M cu. ft.	2,260	1,960	1,960	173	173	127
Posts (round and split):							
Softwood	M pieces	2,000	1,600	1,289	400	295	-
Hardwood	M pieces	2,500	1,500	1,522	1,000	927	-
Total	M pieces	4,500	3,100	2,811	1,400	1,222	-
Fuelwood:							
Softwood	M cords	68	20	1,360	26	1,796	22
Hardwood	M cords	539	212	14,503	279	19,093	48
Total	M cords	607	232	15,863	305	20,889	70
All products:							
Softwood	M cu. ft.	72,145	X	61,711	X	8,869	1,565
Hardwood	M cu. ft.	90,167	X	60,747	X	25,959	3,461
Total	M cu. ft.	162,312	X	122,458	X	34,828	5,026

[1] International 1/4-inch rule.

[2] Rough wood basis.

[3] Includes hewn ties, cabin logs, match bolts, charcoal wood, lath, shingle bolts, etc.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 40.--Total output of roundwood products, by source and species classes, Minnesota, 1960

(In thousand cubic feet)

Source	All species	Softwoods	Hardwoods
Growing-stock trees[1]			
Sawtimber trees	68,664	39,338	29,326
Poletimber trees	53,794	22,373	31,421
Total	122,458	61,711	60,747
Cull trees[1]	11,273	6,065	5,208
Salvable dead trees[1]	3,798	1,574	2,224
Other sources[2]	19,757	1,230	18,527
All sources	157,286	70,580	86,706

[1] On commercial forest land.

[2] Includes noncommercial forest land, nonforest land (such as fence rows), trees less than 5.0 inches in diameter, and limbwood.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 41.--Number of operating primary wood-using plants, by Forest Survey Units, Minnesota, 1960

Kind of plant	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Sawmills:						
Large[1]	1	1	-	-	-	-
Medium[2]	26	8	10	1	7	-
Small[3]	1,255	283	359	47	348	218
Pulpmills	9	3	2	1	3	-
Veneer mills:						
Standard grade	1	-	1	-	-	-
Container	6	-	-	-	6	-
Excelsior plants	-	-	-	-	-	-
Charcoal plants	6	-	4	-	2	-
Cooperage plants	3	-	1	-	2	-
Miscellaneous plants[4]	38	9	17	4	6	2
All plants	1,345	304	394	53	374	220

[1] Annual lumber production, 5 million board feet or more.

[2] Annual lumber production, 1 to 5 million board feet.

[3] Annual lumber production, less than 1 million board feet.

[4] Includes match, rustic fence, woodenware, novelty, lath, and shingle plants.

Table 42.--Annual timber cut from growing stock on commercial forest land, by species, Minnesota, in 1936, 1953, and 1960

(In thousand cubic feet)

Species	Annual timber cut		
	1936	1953	1960
Softwoods:			
White pine	8,210	4,363	3,274
Red pine	3,660	5,475	2,851
Jack pine	12,040	25,326	21,848
Spruce	20,470	23,617	19,332
Balsam fir	8,510	13,375	10,663
Tamarack	3,380	3,074	2,637
Cedar	4,030	2,736	1,913
Total	60,300	77,966	62,518
Hardwoods:			
Hard maple	500	1,169	672
Yellow birch	910	544	444
Basswood	4,200	3,058	2,057
Balsam poplar	(1/)	400	865
Elm	4,610	3,955	2,514
Red oak	8,000	10,453	5,166
White oak	2,670	3,484	3,607
Aspen	22,100	43,949	41,620
Cottonwood	(1/)	1,686	1,155
Paper birch	4,670	3,517	2,460
Soft maple	160	537	452
Ash	(1/)	2,020	1,513
Walnut	(1/)	180	66
Other hardwoods	2,180	1,234	536
Total	50,000	76,186	63,127
All species	110,300	154,152	125,645

1/ Species data not available, included with other hardwoods.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 43.--Annual timber cut from growing stock on commercial forest land, by products and logging residues and species classes, Minnesota, 1960

(In thousand cubic feet)

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	23,934	11,253	12,681
Veneer logs and bolts	1,407	-	1,407
Cooperage logs and bolts	366	-	366
Pulpwood	74,277	45,917	28,360
Piling	105	105	-
Poles	1,254	1,254	-
Mine timbers	481	388	93
Misc. industrial wood	1,960	145	1,815
Posts	2,811	1,289	1,522
Fuelwood	15,863	1,360	14,503
All products	122,458	61,711	60,747
Logging residues	3,187	807	2,380
Timber cut	125,645	62,518	63,127

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 44.--Annual timber cut from live sawtimber on commercial forest land, by products and logging residues and species classes, Minnesota, 1960

(In thousand board feet)[1]

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	134,880	63,410	71,470
Veneer logs and bolts	9,810	-	9,810
Cooperage logs and bolts	2,750	-	2,750
Pulpwood	124,000	88,190	35,810
Piling	480	480	-
Poles	2,570	2,570	-
Mine timbers	1,390	1,120	270
Misc. industrial wood	10,560	800	9,760
Posts	3,830	550	3,280
Fuelwood	22,050	1,890	20,160
All products	312,320	159,010	153,310
Logging residues	8,060	1,140	6,920
Timber cut	320,380	160,150	160,230

[1] International 1/4-inch rule.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 45.--Volume of unused plant residues, by industrial sources and type of residue and by species class, Minnesota, 1960

(In thousand cubic feet)

Industrial source	Species class and character of residues								
	All species			Softwoods			Hardwoods		
	Total	Coarse 1/	Fine 2/	Total	Coarse	Fine	Total	Coarse	Fine
Lumber industry	5,720	2,411	3,309	2,974	1,290	1,684	2,746	1,121	1,625
Veneer industry	23	6	17	-	-	-	23	6	17
Other primary industries	187	55	132	20	20	-	167	35	132
Total	5,930	2,472	3,458	2,994	1,310	1,684	2,936	1,162	1,774

1/ Unused material suitable for chipping, such as slabs, edgings, and veneer cores.

2/ Unused material not suitable for chipping, such as sawdust and shavings.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 46.--Annual desirable cut of growing stock on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand cubic feet)

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	5,388	2,939	1,240	1,162	47	-
Red pine	3,389	1,477	1,730	182	-	-
Jack pine	31,995	21,298	7,971	1,382	285	1,059
Balsam fir	30,802	15,547	8,461	6,747	-	47
White spruce	6,438	4,693	616	1,058	55	16
Black spruce	22,452	10,049	2,576	9,693	-	134
Tamarack	4,969	111	1,935	2,006	672	245
Cedar	10,515	3,468	2,868	3,942	-	237
Total softwoods	115,948	59,582	27,397	26,172	1,059	1,738
Hardwoods:						
Hard maple	2,386	514	901	8	758	205
Yellow birch	340	245	95	-	-	-
Basswood	4,685	71	1,335	387	1,865	1,027
Balsam poplar	17,562	4,938	5,435	4,629	237	2,323
Elm	8,856	450	2,307	1,114	3,421	1,564
Red oak	5,230	134	1,067	71	3,808	150
White oak	4,029	63	585	40	2,441	900
Aspen	128,904	57,030	52,289	12,680	3,318	3,587
Cottonwood	126	-	-	-	110	16
Paper birch	19,663	10,120	6,952	1,904	600	87
Soft maple	1,943	419	466	63	877	118
Ash	7,426	1,943	1,675	1,564	1,738	506
Other hardwoods	1,430	-	-	-	1,177	253
Total hardwoods	202,580	75,927	73,107	22,460	20,350	10,736
All species	318,528	135,509	100,504	48,632	21,409	12,474

Table 47.--Annual desirable cut of live sawtimber on commercial forest land, by species and Forest Survey Units, Minnesota, 1962

(In thousand board feet)[1]

Species	All units	Lake Superior	Central Pine	Rainy River	South-eastern	Western
Softwoods:						
White pine	24,296	12,100	5,800	6,000	296	100
Red pine	15,900	7,000	7,900	900	-	100
Jack pine	69,091	36,800	24,700	2,400	1,291	3,900
Balsam fir	36,100	14,900	14,600	6,600	-	-
White spruce	20,819	13,600	2,600	4,200	319	100
Black spruce	12,200	7,500	1,300	3,400	-	-
Tamarack	6,487	-	2,200	3,200	586	501
Cedar	20,500	8,100	5,800	6,600	-	-
Total softwoods	205,393	100,000	64,900	33,300	2,492	4,701
Hardwoods:						
Hard maple	12,824	1,600	5,300	-	4,282	1,642
Yellow birch	1,600	1,100	500	-	-	-
Basswood	20,965	400	6,100	1,200	8,852	4,413
Balsam poplar	30,922	8,600	12,500	6,900	871	2,051
Elm	44,020	2,700	11,500	4,100	16,459	9,261
Red oak	22,265	200	4,800	300	16,393	572
White oak	15,254	-	2,900	200	9,315	2,839
Aspen	169,386	74,500	67,000	17,500	6,153	4,233
Cottonwood	1,264	-	-	-	1,082	182
Paper birch	22,248	10,600	8,300	2,900	348	100
Soft maple	6,504	100	1,500	200	4,398	306
Ash	21,046	5,400	6,300	3,500	3,890	1,956
Other hardwoods	2,848	-	-	-	2,248	600
Total hardwoods	371,146	105,200	126,700	36,800	74,291	28,155
All species	576,539	205,200	191,600	70,100	76,783	32,856

[1] International 1/4-inch rule.

Table 48.--Net annual growth, annual cut, and desirable cut of growing stock on commercial forest land, by species classes and by ownership classes, Minnesota, 1962

(In thousand cubic feet)

Species class	All owners	National Forest	Other public	Forest industry	Farmer and misc. private
NET ANNUAL GROWTH					
Softwoods	100,593	18,578	49,443	9,409	23,163
Hardwoods	279,616	32,680	104,274	13,740	128,922
All species	380,209	51,258	153,717	23,149	152,085
ANNUAL TIMBER CUT[1]					
Softwoods	62,518	16,968	23,814	6,610	15,126
Hardwoods	63,127	3,690	14,669	3,953	40,815
All species	125,645	20,658	38,483	10,563	55,941
DESIRABLE CUT					
Softwoods	115,948	34,823	52,954	10,025	18,146
Hardwoods	202,580	33,978	81,299	9,907	77,396
All species	318,528	68,801	134,253	19,932	95,542

[1] Annual timber cut figures are for 1960.

NOTE: Refinements in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 49.--Net annual growth, annual cut, and desirable cut of sawtimber on commercial forest land, by species classes and ownership classes, Minnesota, 1962

(In thousand board feet)[1]

Species class	All owners	National Forest	Other public	Forest industry	Farmer and misc. private
NET ANNUAL GROWTH					
Softwoods	308,570	59,020	151,320	20,570	77,660
Hardwoods	520,940	59,840	184,290	19,060	257,750
All species	829,510	118,860	335,610	39,630	335,410
ANNUAL TIMBER CUT[2]					
Softwoods	160,150	41,650	57,050	18,700	42,750
Hardwoods	160,230	11,150	33,600	9,700	105,780
All species	320,380	52,800	90,650	28,400	148,530
DESIRABLE CUT					
Softwoods	205,393	48,700	92,396	23,700	40,597
Hardwoods	371,146	32,000	138,329	21,400	179,417
All species	576,539	80,700	230,725	45,100	220,014

[1] International 1/4-inch rule

[2] Annual timber cut figures are for 1960

NOTE: Refinement in computing and additional data have made some of these statistics different from those reported in "Timber Trends in the U.S.", Forest Resource Report No. 17, published by the Forest Service, U.S. Dept. Agr., in 1965.

Table 50.--Timber growth and cut projections, Minnesota, 1962 to 1992[1]

GROWING STOCK
(In thousand cubic feet)

Year	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1962	125,645	62,518	63,127	380,209	100,593	279,616
1972	141,700	71,600	70,100	386,600	95,300	291,300
1982	166,000	85,900	80,100	407,100	95,300	311,800
1992	199,600	107,800	91,800	432,600	95,600	337,300

SAWTIMBER
(In thousand board feet)[2]

Year	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1962	320,380	160,150	160,230	829,510	308,570	520,940
1972	552,000	249,000	303,000	1,066,000	279,000	787,000
1982	639,000	282,000	357,000	1,495,000	295,000	1,200,000
1992	783,000	340,000	443,000	1,959,000	266,000	1,693,000

[1] Based on following assumptions as to forestry programs and other relevant factors:

(1) Annual planting rate of 50 million conifers.
(2) Regional increase in timber cut as indicated by _Timber Trends in the United States_.
(3) Elm mortality due to Dutch Elm Disease equal to 70 percent of present volume.
(4) Oak mortality after 1970 of twice the 1953-1962 rate.
(5) No withdrawal of commercial forest land from cutting other than the Boundary Waters Canoe Area expansion.

[2] International 1/4-inch rule.

RECENT REPORTS CONCERNING MINNESOTA'S TIMBER RESOURCES

The following Forest Survey Unit and County timber resource reports were published by the Office of Iron Range Resources and Rehabilitation in cooperation with the Lake States Forest Experiment Station and are available at Room 220, St. Louis County Court House, Hibbing, Minnesota, 55746.

Forest Survey Units:
- Lake Superior
- Central Pine

County Reports:
- Aitkin
- Becker
- Beltrami
- Carlton
- Cass
- Clearwater
- Cook
- Crow Wing
- Hubbard
- Itasca
- Koochiching
- Lake
- Lake of the Woods
- Mahnomen
- Pine
- Roseau
- St. Louis
- Wadena

The following Research Notes are available at the North Central Forest Experiment Station, Forest Service—U. S. Department of Agriculture, Folwell Avenue, St. Paul, Minnesota, 55101.

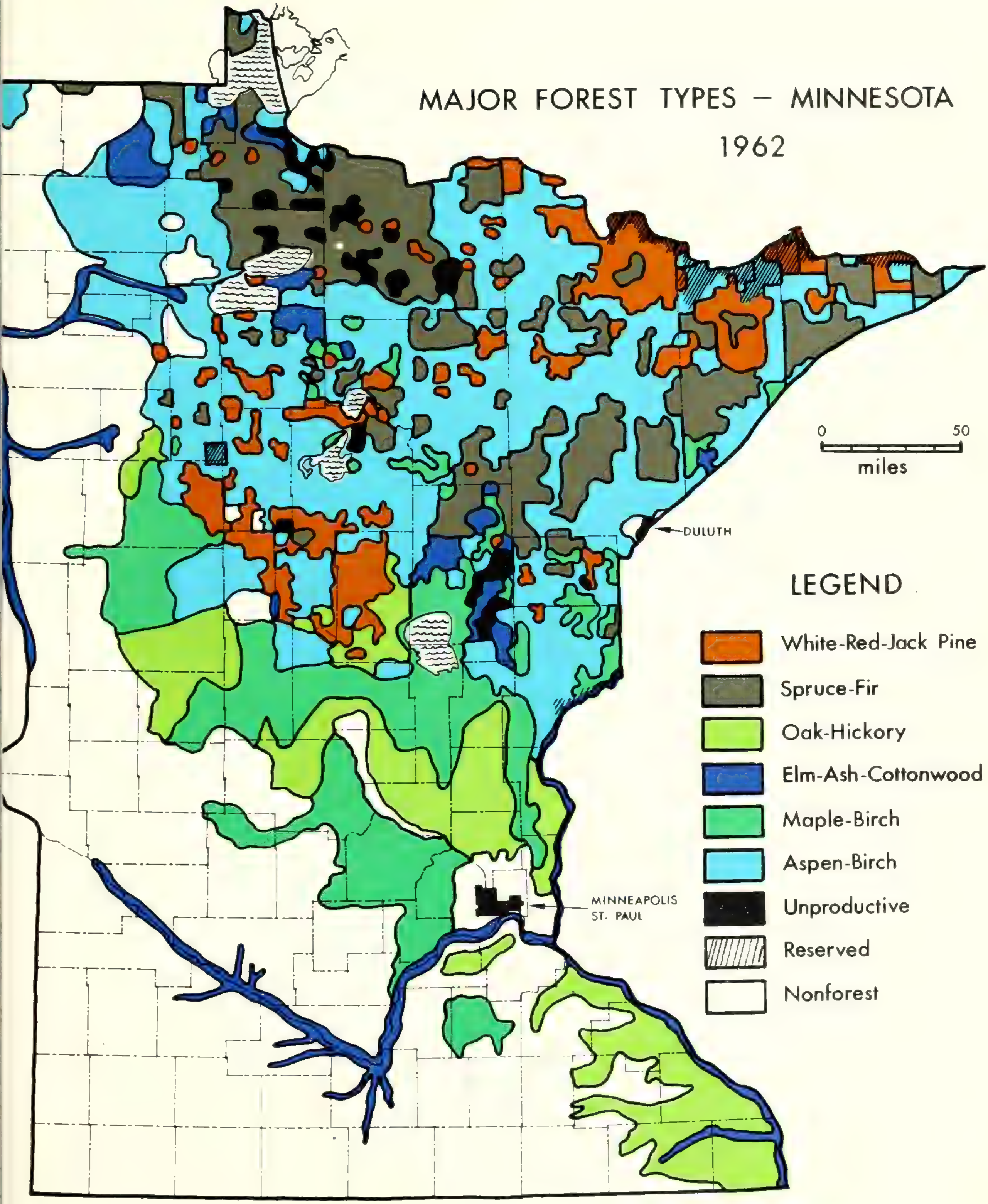
Horn, Arthur G.
1963. Changes in northern Minnesota timber harvest. U.S. Forest Serv. Res. Note LS-11, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.

Stone, Robert N., and Vasilevsky, Alex M.
1963. Forest area trends in Minnesota counties. U.S. Forest Serv. Res. Note LS-25, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.

DeBald, Paul S., and Stone, Robert N.
1964. Minnesota's timber volume. U.S. Forest Serv. Res. Note LS-43, 4 pp. Lake States Forest Exp. Sta., St. Paul, Minn.

Vasilevsky, Alex M., and Stone, Robert N.
1964. Ownership of commercial forest land in Minnesota, 1962. U.S. Forest Serv. Res. Note LS-44, 4 pp. Lake States Forest Exp. Sta., St. Paul, Minn.

Chase, Clarence D.
1964. Forest type areas by counties, Minnesota, 1962. U.S. Forest Serv. Res. Note LS-55, 4 pp., illus. Lake States Forest Exp. Sta., St. Paul, Minn.



MAJOR FOREST TYPES — MINNESOTA
1962

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U.S. FOREST SERVICE
RESOURCE BULLETIN NC-2
SEPTEMBER 1966

PULPWOOD PRODUCTION AND CONSUMPTION

in the

NORTH CENTRAL REGION BY COUNTY

1965

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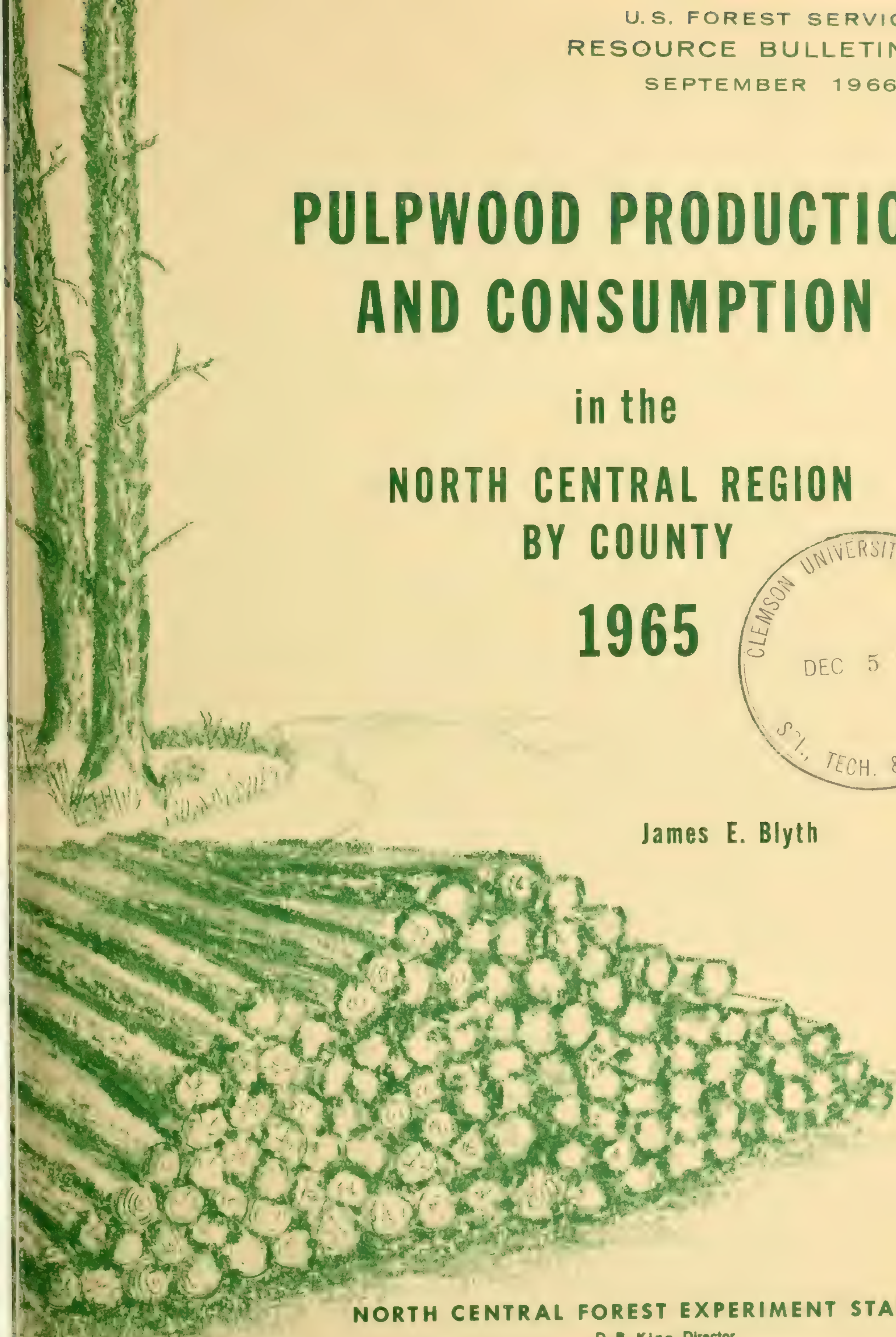
James E. Blyth



NORTH CENTRAL FOREST EXPERIMENT STATION
D. B. King, Director
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

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North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture
Folwell Avenue
St. Paul, Minnesota, 55101

Pulpwood Production and Consumption in the North Central Region by County, 1965

James E. Blyth

The Lake States Forest Experiment Station and art of the Central States Forest Experiment Sta- on were recently combined to form the North entral Forest Experiment Station. Consequently, is seventh annual report of the pulpwood harvest Lake States counties also includes data on the ulpwood harvest in Illinois, Indiana, Iowa, and issouri. These four states are called the "Central ates" in this report.

The volume of timber removed from North entral States forests (Lake States and Central ates) varies from year to year. Frequent meas- ement is required to maintain a current and meaningful picture of the relationships between timber cut, timber growth, and desirable cut. To partially meet this need the Station publishes summaries of the output of various timber products as often as data can be accumulated.

The pulpmills using North Central States timber in 1964 furnished figures showing their pulpwood receipts by State and county. Their cooperation is gratefully acknowledged. Thanks are due also to Ray Pfeifer, Forest Survey Coordinator, Michigan Department of Conservation, for collecting data for the Michigan pulpmills. Robert Knutson, North Central Forest Experiment Station, programmed the computing of the pulpmill data.

PART I. IN THE LAKE STATES

1965 PULPWOOD BRIEFS

ake States Production Stabilizes a High Level

In 1965, the Lake States pulpwood production[1] as 3,636,000 cords, a minor increase of 8,000 rds from 1964 and only 26,000 cords less than e record production of 1963. Ninety-six percent as roundwood; the remainder was residue from cal wood-using plants. Most of the residue was livered to pulpmills as chips.

For the first time since 1958 the cut of maples, ks, and other dense hardwoods as a group de- ned; the decrease from 1964 was about 6 percent. e harvest of birch, balsam fir, and spruce de- eased 29, 15, and 8 percent respectively. On the her hand, hemlock, pine, and aspen production increased. Fifty-one percent of the roundwood harvest was aspen.

The percentage of peeled and rough aspen produced in the Lake States varied widely between States and Forest Survey districts (fig. 1). Rough (i.e., delivered with bark to the mills) and peeled volumes in Minnesota and Michigan were about evenly divided, but, in Wisconsin, more than two-thirds was peeled. Most districts produced more peeled aspen than rough, but in the Rainy River District of Minnesota and in northern Lower Michigan, more than four-fifths of the harvest was rough aspen. The type of production in each district varies with the requirements of the mills to be supplied. For species other than aspen, about 90 percent or more of the harvest in all States was rough wood.

Lake States Mills Again Consume More Than 4 Million Cords

Forty-eight Lake States mills used 4,027,000 cords of pulpwood in 1965, only slightly less than the record consumption of 4,092,000 cords in 1963. The most used species, in order of volume, were aspen, pine, and spruce. Together, these species represented 75 percent of all pulpwood consumed.

Note: Mr. Blyth is a Market Analyst at the North ntral Forest Experiment Station, which is main- ned in St. Paul, Minn., by the Forest Service, U. S. partment of Agriculture, in cooperation with the iversity of Minnesota.

[1] *"Production" is "the harvest of pulpwood from ber lands whereas "consumption" (discussed in later tions) is "the utilization of pulpwood by mills".*

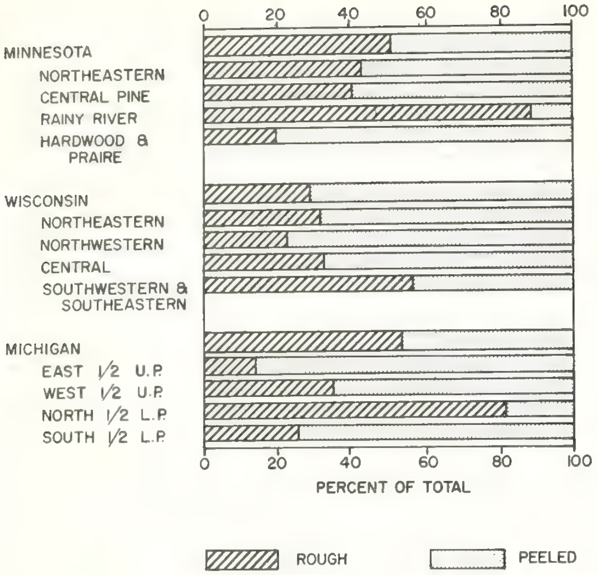

FIGURE 1. — Percent of peeled and rough aspen production of roundwood, by State and Forest Survey District, 1965.

Consumption of aspen and pine increased by 59,000 and 58,000 cords, respectively, above 1964. Significant declines in consumption occurred in balsam fir, miscellaneous hardwoods, spruce, and birch. Use of birch, never a species in great demand, declined almost one-third. Total residue use was up 12,000 cords, although less softwood residue was used.

Region Becoming Less Dependent on Imports

Imports from Canada have dropped from a high of 842,000 cords in 1951 to 297,000 cords in 1965, while imports from other States have increased from a low of 24,000 cords in 1947 to 136,000 cords in 1965. Overall, during the last 20 years, Lake States mills have become less dependent on pulpwood imports from other areas. Nevertheless, the region still obtains 11 percent of its pulpwood from Canada and other States.

Pulpwood exports from Lake States forests to five Central States[2] plants and three Canadian plants in 1965 were about 32,000 cords of spruce, balsam, and miscellaneous hardwoods and 11,000 cords of wood chips and other residues.

The only net export was mixed hardwoods (table 1). Three-fourths of the net imports were composed of spruce and pine.

Lake States mills could probably obtain all of their pulpwood within the region, but for several reasons they import some pulpwood: First, there are occasional price advantages. Secondly, several Lake States mills have connections with Canadian mills and forest properties; the flow of wood fro forest land in one area to mills in other regio is normal when the land and mills are in comm ownership. Also, good procurement strategy m dictate buying wood from other regions as a hed against future wood shortages or high wood cos locally. Amicable business relationships built through pulpwood buying in other regions w be advantageous to the mills involved if th suddenly need larger volumes of imported woo

TABLE 1. — *Pulpwood exports and imports for th Lake States, 1965*
(Thousand standards cords, unpeeled)

Species	Exports	Imports	Net exports o (imports)
Aspen	-	18	(18)
Balsam fir	1	13	(12)
Pine	-	116	(116)
Spruce	19	210	(191)
Mixed hardwoods	12	*	12
Residues, softwood	6	77	(71)
Residues, hardwood	5	9	(4)
Total	43	443	(400)

* Less than 500 cords.

Review of Pulpwood Production by States, 19

Of the 1965 harvest, Michigan produced percent, Wisconsin 34 percent, and Minnesota percent.

Forty-eight Lake States plants used the vario pulping species in 1965 (table 2). Figures 2 a 3 show the amount of roundwood cut relative commercial forest area by county and relative merchantable timber volume by Forest Surv District.

Michigan pulpwood harvest doubles since 194 — For the fourth consecutive year the Michig harvest increased. In 1965, Michigan produc 1,365,000 cords of pulpwood — a gain of 3 perce over 1964 and double the volume produced

TABLE 2. — *Number of plants using the differe species of wood for pulping in 1965*

Species and kind of material	Lake States	Minn.	Wis.	Mich
Aspen	40	7	25	8
Balsam fir	25	7	14	4
Birch	7	1	4	2
Hemlock	8	-	6	2
Pine	12	4	5	3
Spruce	27	5	17	5
Tamarack	5	1	4	-
Misc. hardwoods	14	2	8	4
Wood chips	8	1	4	3
Slabwood and other residue	3	-	3	-
Total plants	48	9	29	10

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[2] *Central States are Indiana, Illinois, Iowa and Missouri.*

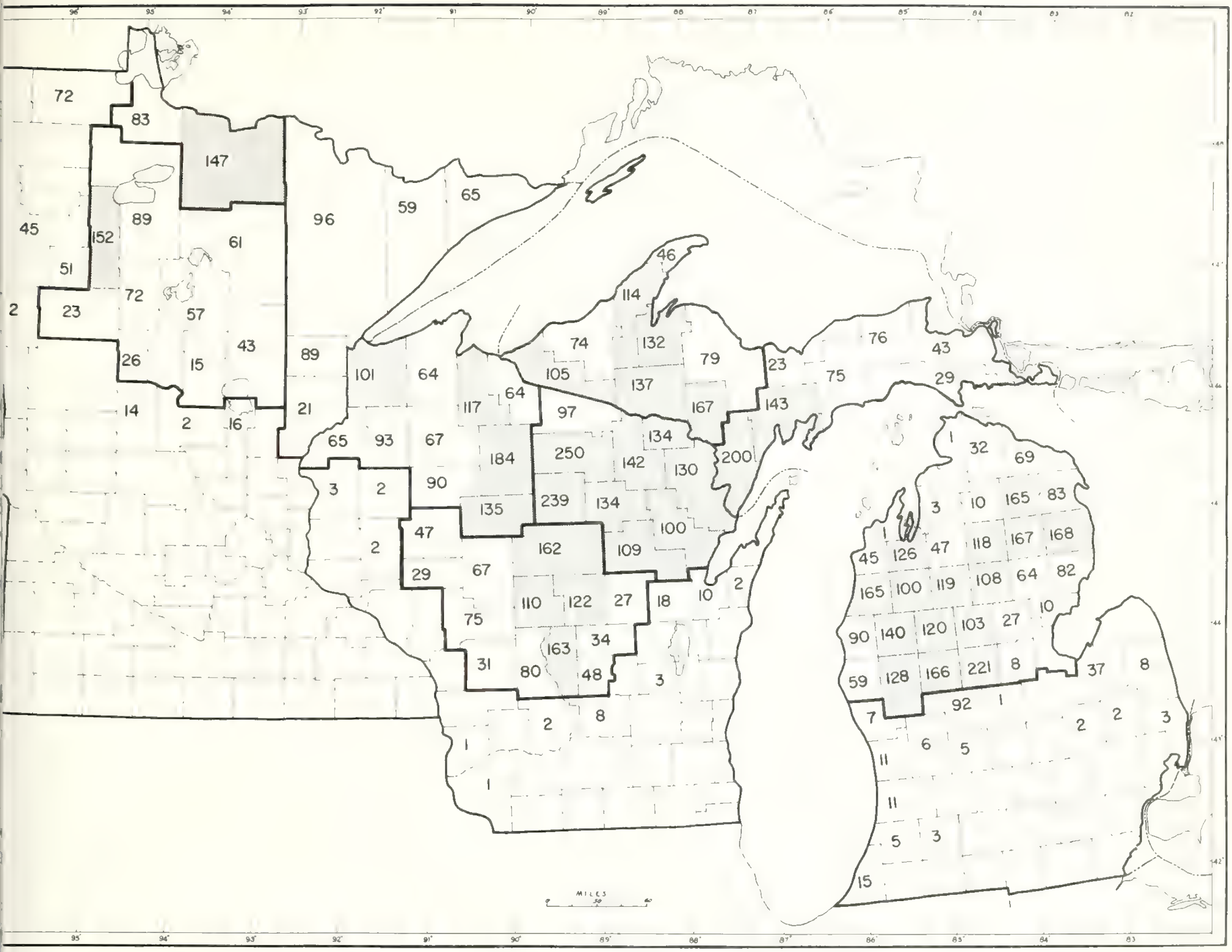


FIGURE 2. — Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in the principal pulpwood-producing counties, 1965. Cross-hatching shows counties that supplied 100 or more cords of pulpwood per 1,000 acres of stocked commercial forest land. The heavy lines delineate the boundaries of the Forest Survey Districts in each State.

47. Resident mills used 55 percent of the Michi- n harvest; Wisconsin received the remainder cept for 7,000 cords shipped out of the region. l of the Michigan wood shipped to Wisconsin me from the Upper Peninsula. The major species t were aspen, pine, miscellaneous hardwoods, d spruce, representing 49, 17, 11, and 9 percent spectively of the Michigan total.

Pulpwood was cut in 62 Michigan counties. The gest cuts were in Menominee (91,000 cords), lta (82,000 cords), and Iron (79,000 cords) unties. The largest production gains (8 percent) re in eastern Upper Michigan. Menominee Coun- made the largest cut of aspen, Marquette Coun- the largest cut of pine, and Manistee County largest cut of miscellaneous hardwoods. In western Upper Michigan, only one county produced less than 40,000 cords; most of the district volume was shipped to Wisconsin. A sharp increase from 1964 in use of residues from southern Lower Michigan more than offset a decrease in residues used from western Upper Michigan.

The Wisconsin harvest changes little. — Wisconsin's 1965 pulpwood harvest inched above 1964 by less than 1 percent to 1,253,000 cords but was 154 percent above the 1947 harvest. Wisconsin mills used 98 percent of this total. Pulpwood output increased by 40,000 cords over 1964 in the Northeastern District. Production was only 35,000 cords in southern Wisconsin but was 67 percent higher than in 1964. Although Wisconsin mills depend less than previously on imports, they still

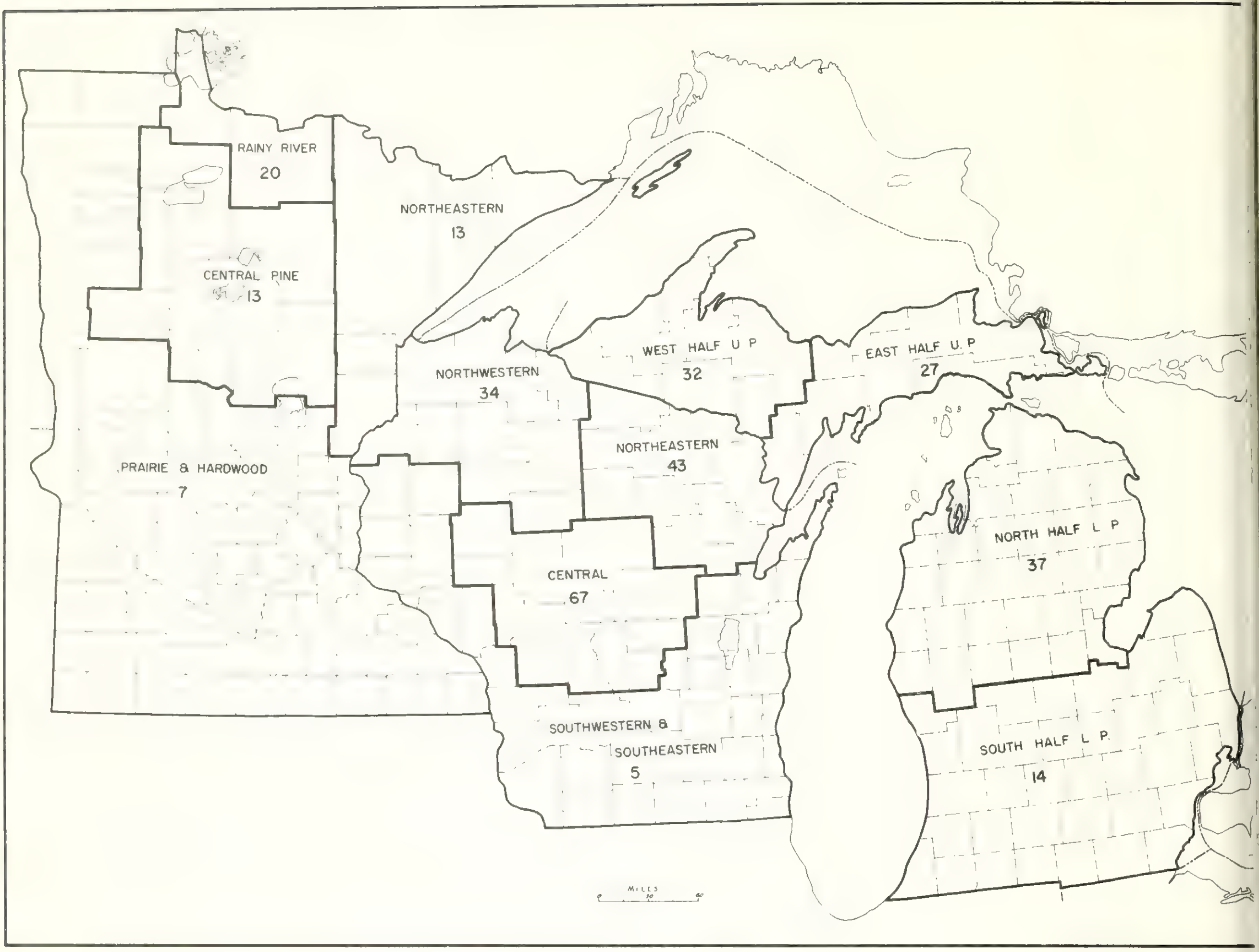


FIGURE 3 — Cords of pulpwood bolts and logs harvested per thousand cords of merchantable volume in principal pulpwood species, by Forest Survey District, 1965.

imported 45 percent of their pulpwood requirements in 1965.

Nearly 50 counties contributed to the 1965 pulpwood harvest. Lincoln County recorded a 22,000-cord gain in output over 1964, but the Price County output decreased 20,000 cords. Top-producing counties were Oneida (120,000 cords), Price (88,000 cords), and Lincoln (77,000 cords). Oneida County harvested the most aspen, Douglas and Washburn Counties the most pine, and Marathon County the most miscellaneous hardwoods. Southwestern counties contributed nearly four times as many cords of residue for pulping as in 1964.

The Minnesota harvest down slightly. — Minnesota's pulpwood production in 1965 equalled the last 5-year average of 1,018,000 cords but was down slightly from 1964. Minnesota now retains 10 percent more of its output than in 1961. Most of this 10 percent had previously been exported to Wisconsin. Exports from northeastern Minnesota to Wisconsin decreased by 39,000 cords from 1964, and the total cut in this district fell by 43,000 cords. Production was stable in the other districts. Of the major pulping species, only aspen recorded a gain.

The pulpwood was cut in 24 Minnesota counties. The major contributors were St. Louis (277,000 cords), second largest pulpwood-producing county east of the Rocky Mountains, Koochiching (205,000 cords), and Itasca (80,000 cords). A sharp production decrease occurred in Lake County primarily because several Wisconsin mills procured less wood there. Aspen and pine cuttings were largest in St. Louis County. Koochiching County supplied the most spruce.

THE SPRUCE PULPWOOD STORY

Spruce has always been one of the most valuble pulpwood resources in the Lake States. The ng fiber characteristic of spruce has made it a uch desired pulpwood for manufacturing highuality papers for writing, magazines, and books. he premium prices paid recently in the Lake tates for spruce pulpwood stumpage reflect its alue to the region.

Currently, spruce ranks fourth in pulpwood roduction in the Lake States, behind aspen, jack ine, and miscellaneous hardwoods. Spruce prouction has been erratic from year to year in the egion but has averaged 376,000 cords annually rom 1946 to 1965. The production averages for -year intervals beginning in 1946 have been as ollows:

	Thousand cords
1946-50	375
1951-55	395
1956-60	394
1961-65	341

Of the three Lake States, Minnesota has always een the volume leader of spruce pulpwood harests. The Minnesota annual cuts have ranged rom a low of 186,000 cords in 1950 to a high of 45,000 cords in 1957 (fig. 4). Average annual roduction during the last 20 years has been aproximately 250,000 cords. About half of the pruce production is shipped out-of-state, primariy to Wisconsin. Exports to Canada have risen in he last 6 years, but shipments to Michigan have been negligible. Minnesota counties in which intensive spruce cutting occurs include Koochiching, St. Louis, and Cook.

During the last 20 years, over two-thirds of the Michigan spruce pulpwood harvest has been exported to Wisconsin mills (fig. 5). In 1965 the Michigan spruce harvest reached a 20-year low of 66,000 cords, about half the production reported 2 decades earlier. More than 95 percent of the spruce pulpwood production comes from Upper Michigan; major producing counties are Marquette, Menominee, Keweenaw, and Delta.

Spruce comprises only 1 percent of the net timber volume in Wisconsin, so it is not surprising that the harvest has never exceeded the 39,000 cords cut in 1952. It has fallen fairly steadily since then to about 15,000 cords in 1965. The 5-year averages and range of production between 1946 and 1965 are shown below.

	Average	*Range*
	Thousand	*cords*
1946-50	32	31-34
1951-55	29	23-39
1956-60	23	18-28
1961-65	18	15-23

All of the spruce is retained in the State.

Spruce is a very important pulping species in Wisconsin where several mills manufacture large

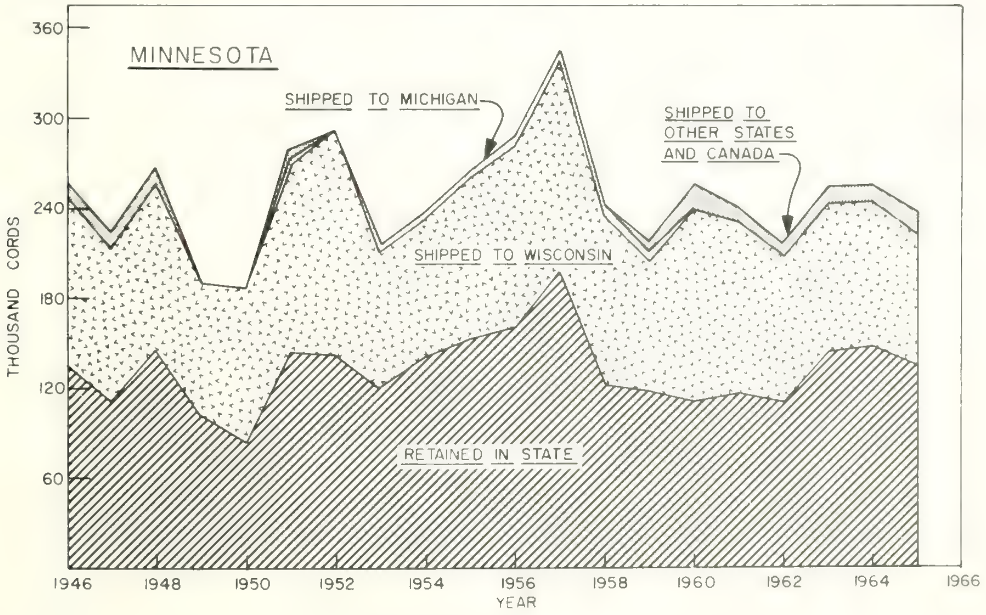


FIGURE 4. — The trend in spruce pulpwood production in Minnesota and its destination by State, 1946-65.

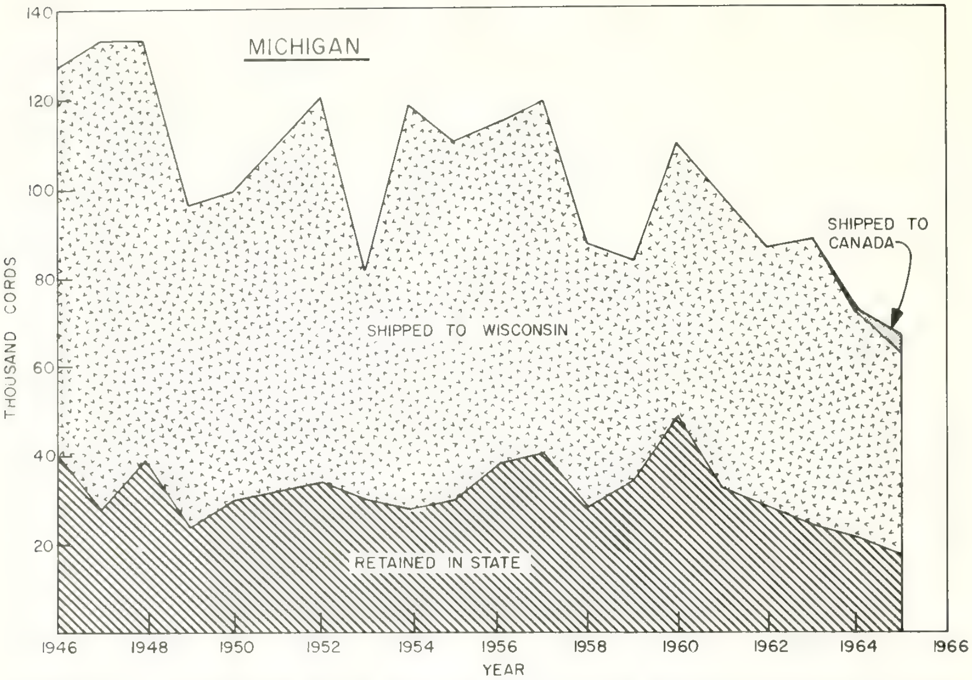


FIGURE 5 — The trend in spruce pulpwood production in Michigan and its destination by State, 1946-65.

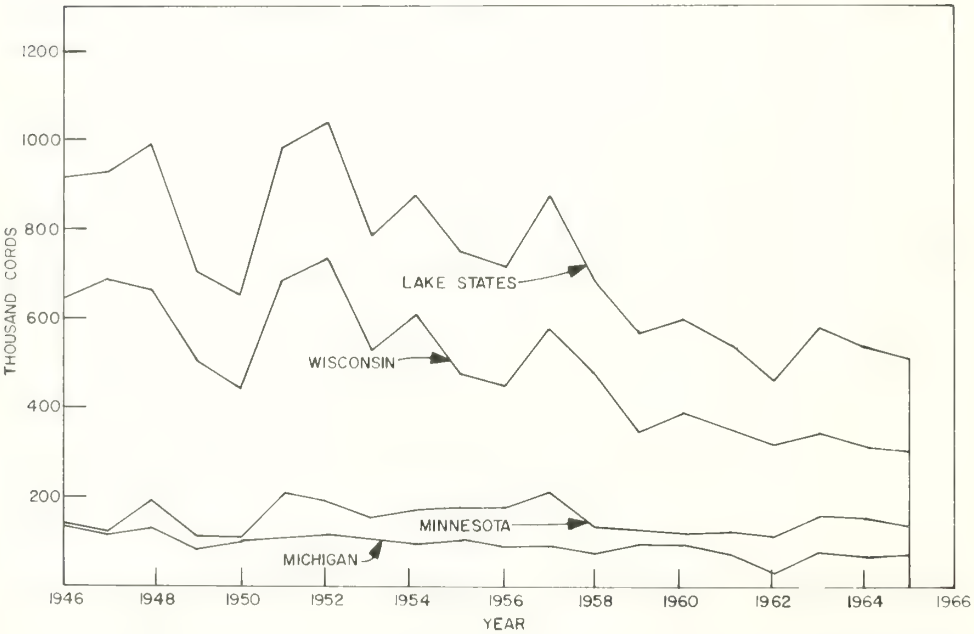


FIGURE 6. — The trend in use of spruce pulpwood in the Lake States by State, 1946-65.

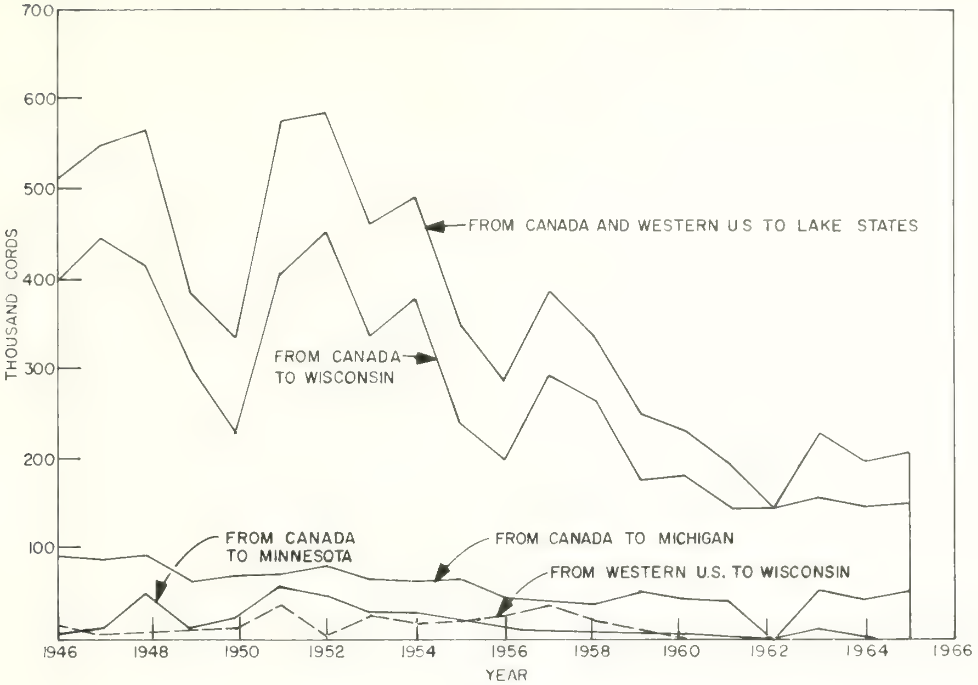


FIGURE 7. — The trend in use of imported spruce pulpwood from western U. S. and Canada, 1946-65. (In 1965, 2,000 cords of spruce pulpwood from western U. S. was used in Minnesota, but is not shown on this chart.)

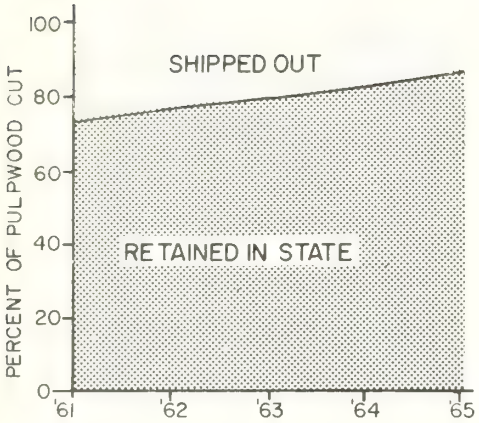
onnages of high-quality papers. Figure 6 shows hat Wisconsin consumes more spruce pulpwood han Minnesota and Michigan combined. However, nnual consumption in Wisconsin now is approximately half of the consumption 20 years ago. Technological advances in pulp and paper manufacturing have allowed higher proportions of short-fibered hardwoods to be mixed with spruce. Since these species cost less than spruce per ton of paper produced, paper manufacturers have continued to seek methods of substituting hardwoods for spruce.

The trend in spruce consumption in Michigan is less sharply downward than in Wisconsin. Since 1955 Michigan has never used more than 100,000 cords annually. Again, short-fibered hardwoods have partially replaced spruce.

In Minnesota, annual spruce consumption during the past 20 years has never fallen below 108,000 cords (1946) and twice has exceeded 200,000 cords (1951 and 1957). Recently it has stabilized at approximately 150,000 cords.

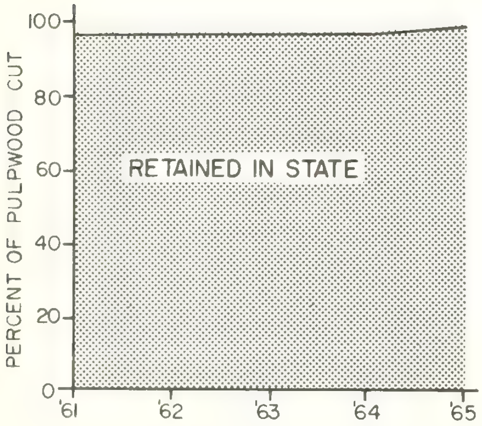
Since Lake States pulpmills use less spruce now than 5 or 10 years ago, the Lake States are more self-sufficient in supplying their spruce needs than in the past. Canada supplies the Lake States with only two-fifths of the spruce volume that it furnished 2 decades ago (fig. 7). About three-fourths of the volume imported goes to Wisconsin from Canada. The remainder goes primarily to Michigan. Until 1960, Wisconsin obtained several thousand cords of spruce annually from a few Western States; since then less than 1,000 cords per year have come from this source. Overall, the Lake States imported about 37 percent of their spruce pulpwood requirements during the last 5 years compared with 56 percent imported from 1946 to 1950.

LAKE STATES PULPWOOD PRODUCTION BY STATE OF ORIGIN AND DESTINATION, 1961-1965



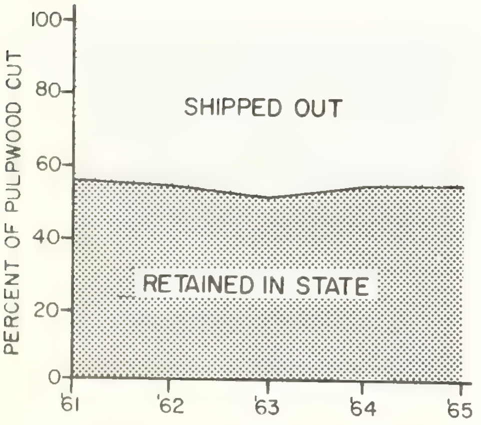
MINNESOTA

Year	Total	Destination of pulpwood			
	cut	Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1961	968	712	240	-	16
1962	979	753	216	1	9
1963	1,063	828	221	-	14
1964	1,062	856	193	-	13
1965	1,018	842	159	-	17
5-year average	1,018	798	206	-	14



WISCONSIN

Total	Total	Destination of pulpwood			
	cut	Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1961	1,078	14	1,050	1	13
1962	1,140	15	1,114	1	10
1963	1,302	20	1,262	2	18
1964	1,244	19	1,207	2	16
1965	1,253	8	1,225	1	19
5-year average	1,203	15	1,172	1	15



MICHIGAN

Total	Total	Destination of pulpwood			
	cut	Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1961	1,106	-	464	628	14
1962	1,223	-	540	677	6
1963	1,297	-	633	664	-
1964	1,321	-	588	730	3
1965	1,365	-	608	750	7
5-year average	1,262	-	566	690	6

LAKE STATES PULPWOOD PRODUCTION BY FOREST SURVEY DISTRICT AND DESTINATION BY STATES, 1965

MINNESOTA

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
Northeastern	416	263	119	-	*
Central Pine	335	331	36	-	2
Rainy River	238	221	2	-	15
Hardwood & Prairie	29	27	2	-	-
Total	1,018	842	159	-	17

WISCONSIN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
Northeastern	583	-	578	1	4
Northwestern	430	2	428	-	*
Central	205	-	203	-	2
Southeastern & Southwestern	35	6	16	-	13
Total	1,253	8	1,225	1	19

MICHIGAN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
E. ½ Up. Pen.	306	-	229	75	2
W. ½ Up. Pen.	466	-	379	84	3
N. ½ Low. Pen.	555	-	-	555	-
S. ½ Low. Pen.	38	-	-	36	2
Total	1,365	-	608	750	7

* Less than 500 cords.

LAKE STATES PULPWOOD PRODUCTION BY SPECIES, STATE, AND FOREST SURVEY DISTRICT, 1961-1965

(Thousand standard cords, roughwood basis)

ASPEN

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	152	170	181	176	177
Central Pine	137	146	150	172	186
Rainy River	74	83	94	91	96
Prairie & Hardwood	6	7	8	12	9
Total	369	406	433	451	468
WISCONSIN:					
Northeastern	280	301	321	332	341
Northwestern	203	210	219	208	220
Central	46	54	71	61	45
Southeastern & Southwestern	1	7	2	2	2
Total	530	572	613	603	608
MICHIGAN:					
E. ½ Up. Pen.	91	96	122	112	142
W. ½ Up. Pen.	168	174	203	206	207
N. ½ Low.Pen.	280	305	314	332	341
S. ½ Low.Pen.	19	26	23	25	14
Total	558	601	662	675	704
Lake States	1,457	1,579	1,708	1,729	1,780

* Less than 500 cords.

BALSAM FIR

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	47	38	31	26	22
Central Pine	35	40	38	32	23
Rainy River	29	32	33	31	28
Prairie & Hardwood	*	-	*	*	*
Total	111	110	102	89	73
WISCONSIN:					
Northeastern	30	24	33	27	25
Northwestern	30	22	27	29	24
Central	1	*	1	1	1
Southeastern & Southwestern	*	*	*	*	-
Total	61	46	61	57	50
MICHIGAN:					
E. ½ Up. Pen.	58	56	63	47	41
W. ½ Up. Pen.	48	44	50	33	30
N. ½ Low.Pen.	9	4	8	4	2
S. ½ Low.Pen.	-	-	-	-	-
Total	115	104	121	84	73
Lake States	287	260	284	230	196

(Cont'd on next page)

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

JACK PINE[1]

State and district	Annual production 1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	127	126	136	129	101
Central Pine	56	53	50	49	56
Rainy River	13	13	14	17	12
Prairie & Hardwood	9	9	8	9	12
Total	205	201	208	204	181
WISCONSIN:					
Northeastern	42	42	45	48	57
Northwestern	35	71	53	51	76
Central	73	70	69	68	72
Southeastern & Southwestern	4	5	3	1	1
Total	154	188	170	168	206
MICHIGAN:					
E. ½ Up. Pen.	38	61	54	51	66
W. ½ Up. Pen.	13	29	36	40	47
N. ½ Low.Pen.	103	93	84	106	110
S. ½ Low.Pen.	2	1	*	1	1
Total	156	184	174	198	224
Lake States	515	573	552	570	611

SPRUCE

State and district	Annual production 1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	131	114	125	118	106
Central Pine	35	40	39	50	38
Rainy River	70	63	90	88	92
Prairie & Hardwood	4	*	1	1	2
Total	240	217	255	257	238
WISCONSIN:					
Northeastern	13	8	14	13	10
Northwestern	10	6	5	6	5
Central	*	1	*	*	*
Southeastern & Southwestern	-	*	*	*	-
Total	23	15	19	19	15
MICHIGAN:					
E. ½ Up. Pen.	45	41	37	33	28
W. ½ Up. Pen.	44	41	46	35	36
N. ½ Low.Pen.	7	4	5	3	1
S. ½ Low.Pen.	-	-	-	-	-
Total	96	86	88	71	65
Lake States	359	318	362	347	318

(Cont'd on next page)

[1] Includes small quantity of red and white pine.

* Less than 500 cords.

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

BIRCH

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	*	*	*	-	-
Central Pine	1	2	*	*	*
Rainy River	-	-	*	-	-
Prairie & Hardwood	-	-	*	-	-
Total	1	2	*	*	*
WISCONSIN:					
Northeastern	12	4	8	8	5
Northwestern	21	31	36	28	17
Central	1	6	6	5	2
Southeastern & Southwestern	*	-	*	*	*
Total	34	41	50	41	24
MICHIGAN:					
E. ½ Up. Pen.	6	5	11	14	5
W. ½ Up. Pen.	5	3	4	6	1
N. ½ Low.Pen.	5	13	8	18	26
S. ½ Low.Pen.	-	-	-	-	-
Total	16	21	23	38	32
Lake States	51	64	73	79	56

* Less than 500 cords.

HEMLOCK

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	-	-	-	-	-
Central Pine	-	-	-	-	-
Rainy River	-	-	-	-	-
Prairie & Hardwood	-	-	-	-	-
Total	-	-	-	-	-
WISCONSIN:					
Northeastern	18	21	25	27	37
Northwestern	25	18	24	22	21
Central	4	3	3	3	2
Southeastern & Southwestern	*	*	*	-	-
Total	47	42	52	52	60
MICHIGAN:					
E. ½ Up. Pen.	2	3	6	10	9
W. ½ Up. Pen.	42	54	56	49	55
N. ½ Low.Pen.	-	-	-	-	-
S. ½ Low.Pen.	-	-	*	-	-
Total	44	57	62	59	64
Lake States	91	99	114	111	124

(Cont'd on next page)

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

TAMARACK

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	3	6	9	7	5
Central Pine	5	3	4	5	6
Rainy River	*	-	-	-	-
Prairie & Hardwood	*	-	*	*	1
Total	8	9	13	12	12
WISCONSIN:					
Northeastern	2	2	1	1	1
Northwestern	5	4	5	3	3
Central	*	*	*	*	-
Southeastern & Southwestern	-	*	*	-	*
Total	7	6	6	4	4
MICHIGAN:					
E. ½ Up. Pen.	2	3	1	2	2
W. ½ Up. Pen.	2	1	2	1	1
N. ½ Low.Pen.	-	-	-	-	*
S. ½ Low.Pen.	-	-	-	-	-
Total	4	4	3	3	3
Lake States	19	19	22	19	19

* Less than 500 cords.

MISC. HARDWOODS

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	1	4	4	3	4
Central Pine	21	21	35	29	24
Rainy River	9	9	9	9	10
Prairie & Hardwood	3	*	3	3	3
Total	34	34	51	44	41
WISCONSIN:					
Northeastern	52	46	50	44	56
Northwestern	67	67	100	93	56
Central	74	69	74	75	77
Southeastern & Southwestern	8	6	9	12	9
Total	201	188	233	224	198
MICHIGAN:					
E. ½ Up. Pen.	2	13	2	7	8
W. ½ Up. Pen.	37	58	54	60	63
N. ½ Low.Pen.	46	67	70	76	75
S. ½ Low.Pen.	11	6	5	3	3
Total	96	144	131	146	149
Lake States	331	366	415	414	388

(Cont'd on next page)

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

RESIDUE & CHIPS 1/

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	-	-	-	-	1
Central Pine	-	-	-	2	2
Rainy River	-	-	-	-	-
Prairie & Hardwood	-	*	1	3	2
Total	-	*	1	5	5
WISCONSIN:					
Northeastern	9	18	55	43	51
Northwestern	7	14	19	15	8
Central	4	8	19	12	6
Southeastern & Southwestern	1	2	5	6	23
Total	21	42	98	76	88
MICHIGAN:					
E. ½ Up. Pen.	-	*	8	6	5
W. ½ Up. Pen.	21	22	25	38	26
N. ½ Low.Pen.	-	-	-	-	-
S. ½ Low.Pen.	-	-	-	3	20
Total	21	22	33	47	51
Lake States	42	64	132	128	144

ALL SPECIES 2/

State and district	Annual production				
	1961	1962	1963	1964	1965
MINNESOTA:					
Northeastern	461	458	486	459	416
Central Pine	290	305	316	339	335
Rainy River	195	200	240	236	238
Prairie & Hardwood	22	16	21	28	29
Total	968	979	1,063	1,062	1,018
WISCONSIN:					
Northeastern	458	466	552	543	583
Northwestern	403	443	488	455	430
Central	203	211	243	225	205
Southeastern & Southwestern	14	20	19	21	35
Total	1,078	1,140	1,302	1,244	1,253
MICHIGAN:					
E. ½ Up. Pen.	249	278	304	282	306
W. ½ Up. Pen.	375	426	476	468	466
N. ½ Low.Pen.	450	486	489	539	555
S. ½ Low.Pen.	32	33	28	32	38
Total	1,106	1,223	1,297	1,321	1,365
Lake States	3,152	3,342	3,662	3,627	3,636

1/ Not reported by district. Prorated on basis of most recent lumber output figures.

2/ Including residues and chips.

* Less than 500 cords.

LAKE STATES PULPWOOD PRODUCTION BY COUNTY AND SPECIES, 1965

MINNESOTA

District 1/ and county	All species	Aspen	Balsam	Birch	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips 2/
	(Thousand standard cords, roughwood basis)								
NORTHEASTERN:									
Carlton	27	23	2	-	2	*	*	-	
Cook	43	-	*	-	-	43	-	-	
Lake	60	6	1	-	34	19	-	-	
Pine	8	6	*	-	*	*	*	2	
St. Louis	277	142	19	-	65	44	5	2	
Total	416	177	22	-	101	106	5	4	1
CENTRAL PINE:									
Aitkin	31	22	2	-	3	3	1	*	
Becker	8	8	*	-	*	*	-	-	
Beltrami	74	36	7	*	14	13	1	3	
Cass	52	30	3	*	9	2	2	6	
Clearwater	49	29	*	*	4	2	*	14	
Crow Wing	6	1	*	-	5	*	*	-	
Hubbard	30	21	*	-	7	1	1	-	
Itasca	80	38	11	-	12	17	1	1	
Wadena	3	1	-	-	2	-	-	-	
Total	335	186	23	*	56	38	6	24	2
RAINY RIVER:									
Koochiching	205	92	27	-	9	67	-	10	
Lake of the Woods	33	4	1	-	3	25	-	-	
Total	238	96	28	-	12	92	-	10	-
HARDWOOD:									
Mille Lacs	2	-	-	-	-	-	-	2	
Morrison	*	*	*	-	*	*	-	-	
Otter Tail	*	*	-	-	-	*	-	-	
Todd	2	*	-	-	2	-	-	-	
Total	6	*	*	-	2	*	-	2	2
PRAIRIE:									
Clay	*	*	-	-	-	-	-	-	-
Mahnomen	6	5	-	-	*	-	-	1	
Polk	3	1	*	-	*	1	1	-	
Roseau	14	3	*	-	10	1	-	-	
Total	23	9	*	-	10	2	1	1	-
State total	1,018	468	73	*	181	238	12	41	5

1/ Includes only those counties that supplied pulpwood in 1965.

2/ County figures are not available.

* Less than 500 cords.

WISCONSIN

District & county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[2]
	(Thousand standard cords, roughwood basis)									
NORTHEASTERN:										
Florence	33	26	1	-	3	*	1	-	2	
Forest	72	50	6	-	8	3	1	*	4	
Langlade	46	30	2	*	1	3	*	*	10	
Lincoln	77	46	3	1	2	8	1	*	16	
Marinette	69	45	4	-	5	10	2	*	3	
Oconto	37	29	1	-	2	2	*	-	3	
Oneida	120	75	6	2	2	19	4	1	11	
Shawano[3]	39	20	1	*	11	3	*	-	4	
Vilas	39	20	1	2	3	9	1	*	3	
Total	583	341	25	5	37	57	10	1	56	51
NORTHWESTERN:										
Ashland	57	38	8	1	3	1	1	1	4	
Bayfield	46	25	2	3	2	13	-	-	1	
Burnett	18	3	-	*	*	15	*	*	*	
Douglas	51	27	*	*	-	22	1	*	1	
Iron	24	14	4	1	2	1	1	-	1	
Price	88	52	5	8	3	1	1	1	17	
Rusk	28	15	*	*	1	-	*	*	12	
Sawyer	38	20	2	3	4	1	*	1	7	
Taylor	41	19	2	1	6	*	*	*	13	
Washburn	31	7	1	-	*	22	1	*	*	
Total	430	220	24	17	21	76	5	3	56	8
CENTRAL:										
Adams	33	1	-	-	-	19	-	-	13	
Chippewa	10	9	-	-	*	1	-	-	-	
Clark	17	6	*	*	*	1	*	-	10	
Eau Claire	4	1	-	-	*	3	-	-	-	
Jackson	22	1	-	-	-	18	-	-	3	
Juneau	18	1	-	-	-	12	-	-	5	
Marathon	48	20	1	2	2	2	*	-	21	
Marquette	3	-	-	-	-	*	-	-	3	
Monroe	7	*	-	-	-	6	-	-	1	
Portage	14	1	*	*	*	4	*	-	9	
Waupaca	3	3	*	*	*	*	*	-	*	
Waushara	4	*	-	-	-	2	-	-	2	
Wood	16	2	-	-	*	4	-	-	10	
Total	205	45	1	2	2	72	*	-	77	6

WISCONSIN (cont'd)

District1/ & county	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue2/ & chips
	(Thousand standard cords, roughwood basis)									
SOUTHWESTERN:										
Barron	1	1	–	–	–	–	–	–	–	
Buffalo	*	–	–	*	–	–	–	–	–	
Crawford	1	–	–	–	–	–	–	–	1	
Dunn	*	*	–	–	–	*	–	–	–	
Grant	4	–	–	–	–	–	–	–	4	
Iowa	3	–	–	–	–	–	–	–	3	
Polk	1	*	–	–	–	1	–	*	–	
Sauk	*	–	–	–	–	*	–	–	–	
Trempealeau	*	–	–	–	–	*	–	–	–	
Total	29	1	–	*	–	1	–	*	8	19
SOUTHEASTERN:										
Brown	*	*	–	–	–	*	–	–	–	
Columbia	1	*	–	–	–	*	–	–	1	
Door	*	*	–	–	–	–	–	–	–	
Fond du Lac	*	–	–	–	–	*	–	–	–	
Kewaunee	*	*	–	–	–	–	–	–	–	
Outagamie	1	1	–	–	–	–	–	*	*	
Washington	*	–	–	–	–	*	–	–	–	
Total	6	1	–	–	–	*	–	*	1	4
State total	1,253	608	50	24	60	206	15	4	198	88

1/ Includes only those counties that supplied pulpwood in 1965.

2/ County figures are not available.

3/ Includes Menominee County.

* Less than 500 cords.

MICHIGAN

District & county 1/	All species	Aspen	Balsam	Birch	Hem- lock	Pine	Spruce	Tam- arack	Misc. hdwds.	Residue 2/ & chips
	(Thousand standard cords, roughwood basis)									
E. ½ UP. PEN.:										
Alger	11	2	1	*	*	7	1	-	*	
Chippewa	30	3	2	*	1	18	5	1	-	
Delta	82	42	15	*	2	10	7	*	6	
Luce	34	8	2	3	4	14	3	*	*	
Mackinac	15	4	6	1	-	2	2	-	*	
Menominee	91	71	9	*	1	1	6	1	2	
Schoolcraft	38	12	6	1	1	14	4	*	*	
Total	306	142	41	5	9	66	28	2	8	5
W. ½ UP. PEN.										
Baraga	63	30	4	-	5	3	7	-	14	
Dickinson	62	48	4	*	1	4	3	1	1	
Gogebic	54	21	2	*	19	*	1	*	11	
Houghton	58	15	3	*	17	5	4	-	14	
Iron	79	48	7	1	6	2	7	*	8	
Keweenaw	9	-	3	-	-	-	6	-	-	
Marquette	71	25	6	*	1	32	7	-	*	
Ontonagon	44	20	1	*	6	1	1	*	15	
Total	466	207	30	1	55	47	36	1	63	26
N. ½ LOW.PEN.										
Alcona	52	40	*	4	-	1	1	-	6	
Alpena	18	13	1	2	-	*	*	-	2	
Antrim	*	*	-	*	-	-	-	-	-	
Arenac	1	1	-	*	-	-	-	-	*	
Benzie	5	3	-	1	-	*	*	*	1	
Cheboygan	10	8	*	1	-	1	*	*	*	
Clare	18	15	-	1	-	1	-	-	1	
Crawford	32	8	-	1	-	21	-	-	2	
Emmett	*	*	-	-	-	*	-	-	-	
Gladwin	3	3	-	*	-	-	-	-	*	
Grand Traverse	14	9	-	1	-	2	-	-	2	
Iosco	17	5	*	*	-	12	*	-	*	
Isabella	16	15	-	-	-	-	-	-	1	
Kalkaska	9	6	-	*	-	3	-	-	*	
Lake	40	14	-	1	-	12	-	-	13	
Leelanau	*	*	-	-	-	*	-	-	*	
Manistee	34	12	-	1	-	2	-	-	19	
Mason	14	7	-	*	-	1	-	-	6	
Mecosta	17	16	-	*	-	*	-	-	1	
Midland	1	1	-	*	-	-	-	-	-	
Missaukee	21	14	-	1	-	4	-	-	2	
Montmorency	42	29	*	3	-	5	-	-	5	
Newaygo	34	26	-	*	-	3	-	-	5	
Oceana	7	6	-	*	-	*	-	-	1	
Ogemaw	16	7	-	1	-	8	-	-	*	
Osceola	18	14	-	*	-	*	-	-	4	
Oscoda	47	21	-	2	-	24	-	-	*	
Otsego	2	2	-	*	-	*	-	-	*	
Presque Isle	19	13	1	2	-	2	*	-	1	
Roscommon	28	18	-	3	-	6	-	-	1	
Wexford	20	15	-	1	-	2	-	-	2	
Total	555	341	2	26	-	110	1	*	75	-

District & county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[2]
				(Thousand standard cords, roughwood basis)						
S. ½ LOW.PEN.										
Allegan	1	*	-	-	-	-	-	-	1	
Barry	*	-	-	-	-	-	-	-	*	
Berrien	1	*	-	-	-	-	-	-	1	
Genessee	*	*	-	-	-	-	-	-	-	
Gratiot	*	*	-	-	-	-	-	-	*	
Ionia	*	*	-	-	-	-	-	-	-	
Kalamazoo	*	-	-	-	-	-	-	-	*	
Kent	1	1	-	-	-	*	-	-	*	
Lapeer	*	*	-	-	-	-	-	-	-	
Montcalm	9	8	-	-	-	*	-	-	1	
Muskegon	1	1	-	-	-	*	-	-	*	
Ottawa	1	*	-	-	-	1	-	-	*	
St. Claire	*	*	-	-	-	-	-	-	-	
Sanilac	*	*	-	-	-	-	-	-	-	
Tuscola	4	4	-	-	-	-	-	-	-	
Van Buren	*	*	-	-	-	-	-	-	*	
Total	38	14	-	-	-	1	-	-	3	20
State total	1,365	704	73	32	64	224	65	3	149	51

[1] Includes only those counties that supplied pulpwood in 1965.

[2] County figures are not available.

* Less than 500 cords.

PART II. IN THE CENTRAL STATES

1965 PULPWOOD BRIEFS

Both production and consumption of pulpwood declined in the Central States in 1965. Production and use of residues rose but roundwood production and use declined sharply, partly because of a woods labor shortage. The region was a net importer of pulpwood. Regional roundwood production and consumption were nearly equal.

Roundwood Harvest Declines 16 Percent

In 1965, the pulpwood cut in the Central States was 204,200 cords, 41,600 cords less than in 1964 and the smallest cut since 1960. The harvest declined in all four States as shown in the 5-year summary below

	In thousand cords				
State	*1961*	*1962*	*1963*	*1964*	*1965*
Illinois	98	120	102	105	77
Indiana	73	87	79	85	82
Iowa	22	28	20	33	25
Missouri	15	21	21	23	20
Total	208	256	222	246	204

More than half of the total decline occurred in Illinois where less than two-thirds of the record harvest of 1962 was attained; insufficient woods labor was a major reason. The smallest decline, less than 4 percent, was in Indiana. Missouri cut less pulpwood than the others; yet the potential of Missouri's forests for pulpwood output is large if closer markets become available. Overall, the harvest of poletimber-size trees in Missouri could be quadrupled without exceeding desirable cutting levels.

Soft hardwoods comprised almost two-thirds of the regional pulpwood cut in 1965, hard hardwoods about one-third, and softwoods only two percent. Compared to 1964, the cut of all three species groups declined — hard hardwoods by 18,400 cords, soft hardwoods by 17,800 cords, and softwoods by 5,400 cords. The largest percentage drop, 56 percent, was in softwoods.

Illinois and Indiana were the leading producers of soft hardwood pulpwood in the Central States in 1965, with 56,500 cords and 46,500 cords, respectively. Only 4,300 cords of soft hardwoods harvested in Indiana were shipped out of the region. Indiana had the only yearly increase in soft hardwood production — about 1,400 cords. The largest decrease was 14,100 cords in Illinois.

As for hard hardwoods, Indiana was the leading pulpwood producer followed by Illinois, Iowa, and Missouri. Only 1,000 cords left the Central States. Each State had less hard hardwood production than the previous year, and major declines of nearly one-third occurred in Illinois and Iowa.

More than half of the regional softwood cut for pulping was shipped to other areas. Although production in Illinois decreased 5,600 cords (63 percent), it still comprised more than three-fourths of the volume cut in the four States. The remaining softwood cut was in Indiana and Missouri.

At the county level, only Will County in Illinois produced over 10,000 cords of pulpwood in 1965 (fig. 8). Other high-producing counties were Sullivan, Ripley, and Gibson in Indiana. Cutting occurred in 129 counties — 55 in Illinois, 42 in Indiana, 17 in Iowa, and 15 in Missouri. As might be expected, most of the cutting was in counties close to pulpmills. Most of the mills satisfied their pulpwood requirements within 50 miles of the mill.

Residue Consumption Increases 400 Percent Since 1961

Consumption of 46,000 cords of residue by 10 of the 15 Central States mills in 1965 eclipsed the previous record of 39,000 cords in 1964 (table 3). A slight drop in the residues used in Illinois was more than offset by increases in the rest of the region. Local forest industries supplied 54 percent of the wood residues; the remainder came from eight other States.

One-fourth of the residue used was softwood, and more than 90 percent of the softwood residue came from States outside the region. These states in order of volume, were Texas, Wisconsin, Michigan, Mississippi, and Louisiana. About 37 percent of these imports were chips; the rest was wood flour, sawdust, and veneer cores.

Of the 34,600 cords of hardwood residue used by Central States pulpmills, three-fifths was chips and the remainder was primarily slabs from sawmills. Thirty-one percent came from Wisconsin, Louisiana, Kentucky, Mississippi, and Pennsylvania; the remainder came from forest industries within the region. Only 2,100 cords of hardwood residue was shipped from the Central States.

Residues now account for more than one-sixth of the pulpwood used in the Central States. The expanding substitution of residues for roundwood is likely to continue as more sawmills add debarkers and chippers.

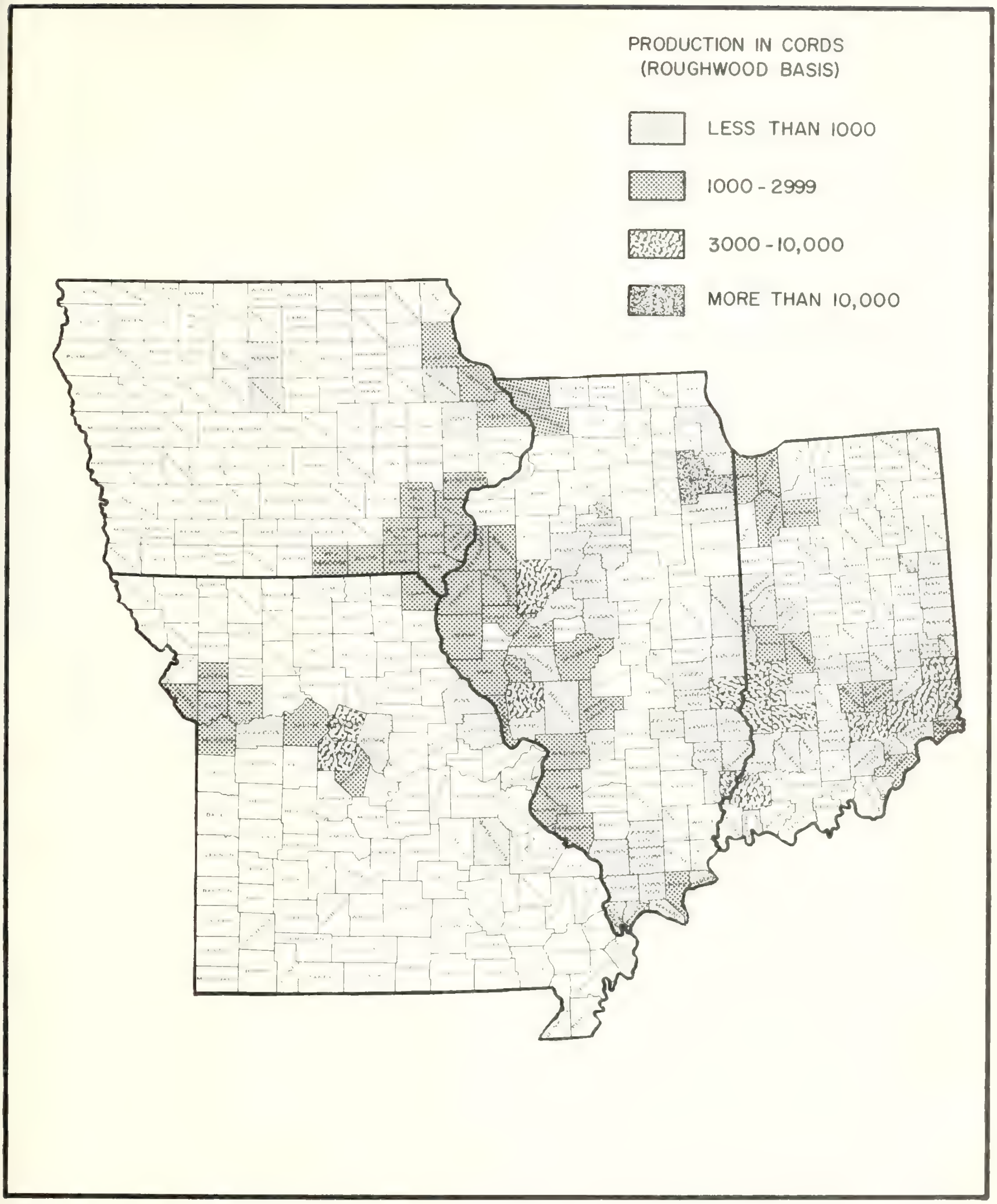


FIGURE 8. — Harvest of pulpwood bolts by counties, 1965.

TABLE 3. — *Trends in consumption of roundwood and residues as pulpwood, Central States, 1961-65*

(Thousand cords)

Type of material and area	1961	1962	1963	1964	1965
Roundwood					
Illinois	95	106	91	82	68
Indiana, Iowa, Missouri	130	160	142	163	143
Total	225	266	233	245	211
Residue					
Illinois	8	13	17	25	22
Indiana, Iowa, Missouri	1	7	12	14	24
Total	9	20	29	39	46
All material	234	286	262	284	257

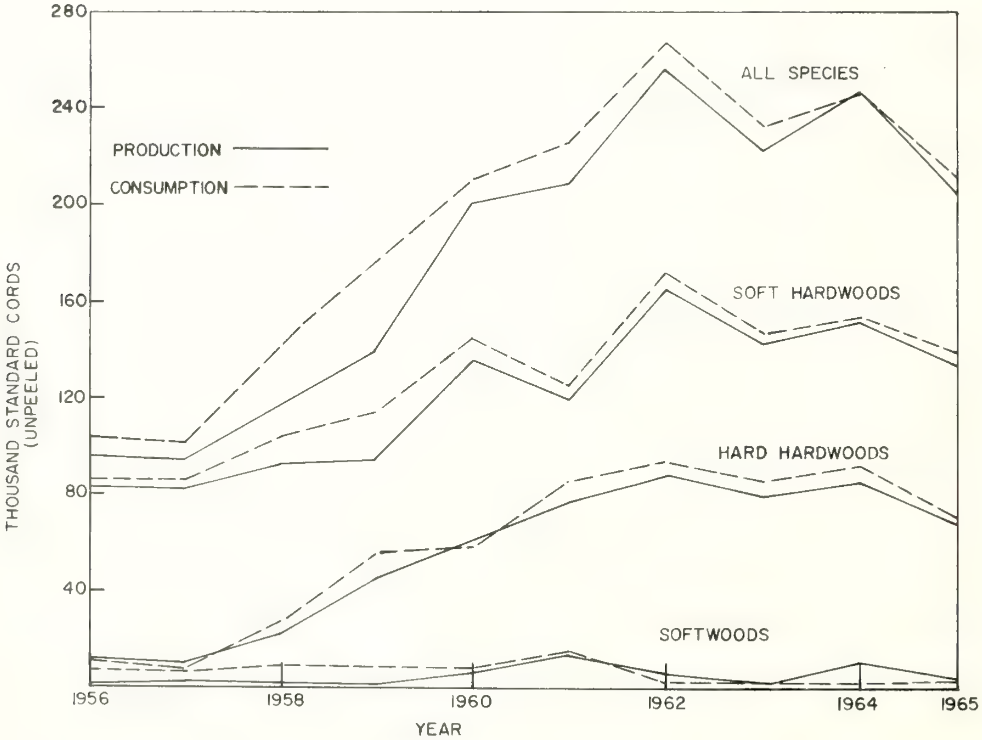


FIGURE 9. — Round pulpwood production and consumption in the Central States, 1956-65.

oundwood Consumption Down

Roundwood consumption dropped to 211,600 rds in 1965, a decrease of 34,000. Ninety-six per-nt of the Central States roundwood harvest was sed by regional mills.

Since 1962, annual consumption of roundwood Illinois has fallen sharply each year (table 3). uring the same period roundwood use in other arts of the region reveals no trend.

Soft hardwoods comprised nearly two-thirds of he bolts used, and hard hardwoods the other one-hird. Less than one percent was softwood.

linois is a Large Importer

Illinois received 48 percent of all pulpwood nported into the Central States in 1965. Nearly ne-fifth of the pulpwood consumed in Illinois ame from States outside the region, and more han two-thirds of the wood imported by Illinois as in the form of residues.

Net pulpwood imports into the Central States n 1965 were 26,600 cords — 7,400 cords of round-ood and 19,200 cords of residue. Although the egion had net exports of 2,600 cords of softwood olts, net imports of softwood residues were 10,600 cords. The Lake States contributed 21,000 cords of bolts and residue to Central States pulpmills, and other States furnished 15,600 cords. Exported pulpwood went to five mills in five widely dispersed States.

Roundwood Production and Consumption Approach Equality

Figure 9 shows that since 1959 the gap between production and consumption of roundwood in the Central States has narrowed although the difference has been small for many years. In 1964, production exceeded consumption by 1,000 cords, but was slightly less than consumption in 1965.

During the last 4 years, the regional softwood harvest has equalled or exceeded consumption, a reversal of the pattern for the previous 6 years. Soft hardwood bolt imports have decreased in recent years although consumption still exceeds production. During the last 5 years, imports of soft hardwood bolts has been signficantly less than during the previous 5 years. Thus, the region is becoming more self-sufficient in supplying roundwood to resident mills, and a larger share of the value added and man-hours used in pulpwood production for these mills occurs within the region. The overall effect is a tendency to strengthen the regional economy.

CENTRAL STATES PULPWOOD PRODUCTION AND RECEIPTS BY STATE, 1965

Species group and destination	Production by States[1/]					Imports			Total receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake States	Other U. S.	Total imports	
	(In standard cords, unpeeled)[2/]								
Softwoods									
Illinois	881	498	-	253	1,632	-	-	-	1,632
Ind., Iowa, Mo.[3/]	-	-	-	-	-	-	-	-	-
Exported[4/]	2,430	157	-	-	2,587	-	-	-	-
Total	3,311	655	-	253	4,219	-	-	-	1,632
Soft hardwoods									
Illinois	44,901	8,490	-	263	53,654	1,332	3,677	5,009	58,663
Ind., Iowa, Mo.	11,651	33,698	12,596	17,036	74,981	4,885	722	5,607	80,588
Exported[4/]	-	4,334	-	-	4,334	-	-	-	-
Total	56,552	46,522	12,596	17,299	132,969	6,217	4,399	10,616	139,251
Hard hardwoods									
Illinois	6,501	1,484	-	-	7,985	-	-		7,985
Ind., Iowa, Mo.	10,985	32,573	12,000	2,427	57,985	4,000	726	4,726	62,711
Exported[4/]	-	943	82	-	1,025	-	-	-	-
Total	17,486	35,000	12,082	2,427	66,995	4,000	726	4,726	70,696
Total roundwood									
Illinois	52,283	10,472	-	516	63,271	1,332	3,677	5,009	68,280
Ind., Iowa, Mo.	22,636	66,271	24,596	19,463	132,966	8,885	1,448	10,333	143,299
Exported[4/]	2,430	5,434	82	-	7,946	5,922	802	6,724	7,502
Total	77,349	82,177	24,678	19,979	204,183	10,217	5,125	15,342	211,579
Residues, softwood									
Illinois	778	-	-	-	778	5,922	802	6,724	7,502
Ind., Iowa, Mo.	-	-	-	-	-	-	3,903	3,903	3,903
Total	778	-	-	-	778	5,922	4,705	10,627	11,405
Residues, hardwood									
Illinois	8,626	-	-	34	8,660	-	5,822	5,822	14,482
Ind., Iowa, Mo.	4,956	3,931	6,401	-	15,288	4,859	-	4,859	20,147
Exported[4/]	-	-	-	2,112	2,112	-	-	-	-
Total	13,582	3,931	6,401	2,146	26,060	4,859	5,822	10,681	34,629
All wood material									
Illinois	61,687	10,472	-	550	72,709	7,254	10,301	17,555	90,264
Ind., Iowa, Mo.	27,592	70,202	30,997	19,463	148,254	13,744	5,351	19,095	167,349
Exported[4/]	2,430	5,434	82	2,112	10,058	-	-	-	-
Total	91,709	86,108	31,079	22,125	231,021	20,998	15,652	36,650	257,613

[1/] Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

[2/] Factors used in converting to standard green cords (128 cu. ft.) were: 4,500 pounds of soft-hardwood roundwood; 5,000 pounds of hard-hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

[3/] Combined to prevent disclosure of individual mill receipts.

[4/] Pulpwood shipped to mills outside the region.

REPORTS ON PULPWOOD PRODUCTION PUBLISHED BY THE NORTH CENTRAL FOREST EXPERIMENT STATION

Reports of pulpwood production have been published by the Station since 1946. One group of short 2-page Notes gives information by State and species. Another group of longer reports begun in 1959 gives more detailed information by County. All of these publications were prepared by Arthur G. Horn.

The longer reports are:

Pulpwood Production in Lake States Counties.

1959 data:	Station Paper 85, 13 pp.
1960 data:	Station Paper 94, 28 pp.
1961 data:	Station Paper 106, 18 pp.
1962 data:	Research Paper LS-5, 16 pp.
1963 data:	Resource Bulletin LS-1, 17 pp.
1964 data:	Resource Bulletin LS-2, 19 pp.

The 2-page Notes are:

Aspen Takes Lead as Pulping Species in Lake States (1946 data). Tech. Note 288.
Lake States Pulpwood Production Declines in 1947. Tech. Note 301.
Near Record Cut of Pulpwood in Lake States — 1948. Tech. Note 320.
Pulpwood Harvest Declines to Prewar Level in Lake States — 1949. Tech. Note 336.
Lake States Pulpwood Production Reverses Trend, 1950. Tech. Note 364.
Ten Years' Pulpwood Production in the Lake States (1942-1951). Tech. Note 384.
1951 Lake States Pulpwood Production Reaches All-Time High. Tech. Note 398.
1952 Lake States Pulpwood Production Continues at High Level. Tech. Note 399.
Aspen Makes Up Nearly One-Half of 1953 Pulpwood Cut in Lake States. Tech. Note 418.
Production of Pulpwood Continues at High Level in the Lake States, 1954. Tech. Note 436.
Lake States Pulpwood Production Shows Increase in 1955; Canadian Imports Decrease. Tech. Note 456.
Some Highlights of Pulpwood Production in the Lake States, 1946-1955. Tech. Note 457.
Lake States Pulpwood Production Reaches New High, 1956. Tech. Note 495.
Lake States Pulpwood Production Remains High — Hardwood Cut Climbs, 1957. Tech. Note 529.
Trend of Pulpwood Harvest Up in Wisconsin, Particularly in Central Area (1957). Tech. Note 531.
Lake States Pulpwood Production and Imports Decline in 1958. Tech. Note 558.
Lake States Pulpwood Production Exceeds 3 Million Cords, 1959. Tech. Note 588.
Lake States Pulpwood Production Up 11 Percent in 1960. Tech. Note 606.
Production and Imports of Pulpwood Decline in the Lake States, 1961. Tech. Note 624.
Lake States Pulpwood Production Up While Canadian Imports Drop to All-Time Low, 1962. Res. Note LS-23.
Lake States Pulpwood Cut Continues to Climb: Wisconsin Takes Lead in Pulpwood Production (1963). Res. Note LS-48.
Lake States Pulpwood Production Levels Off, 1964. Res. Note LS-65.
Lake States Pulpwood Production Hampered by Adverse Weather and Labor Shortage, 1965. Res. Note NC-3.

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U.S. FOREST SERVICE
RESOURCE BULLETIN NC-3
SEPTEMBER 1967

PULPWOOD PRODUCTION AND CONSUMPTION

in the

NORTH CENTRAL REGION BY COUNTY

1966

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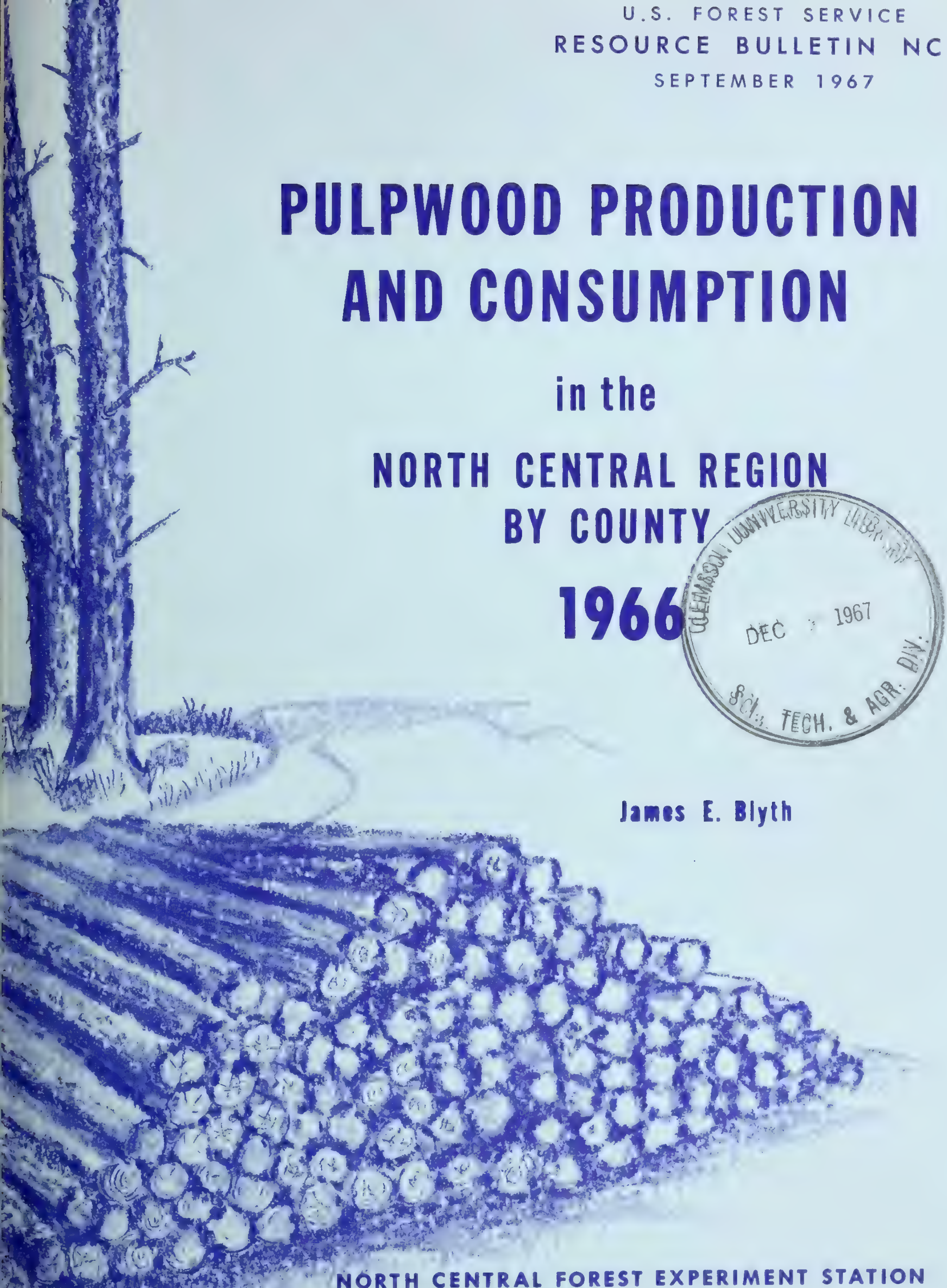

NORTH CENTRAL FOREST EXPERIMENT STATION
D. B. King, Director
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

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Pulpwood Production and Consumption in the North Central Region by County, 1966

James E. Blyth

The volume of timber removed from the forests of the North Central States (Lake States and Central States) varies from year to year. Frequent measurement is required to maintain a current and meaningful picture of the relationships between timber removal, timber growth, and desirable cut. To partially meet this need the Station publishes summaries of the output of various timber products as often as data can be accumulated.

This is the eighth annual report on the pulpwood harvest in Lake States Counties and the seventh annual report on the Central States harvest. The Lake States and Central States are discussed separately because the timber types in each area are quite different and less information can be released about the Central States: More detailed data published on pulpwood production and consumption in the Central States would reveal the operations of individual mills.

The pulpmills using North Central States timber in 1966 furnished figures showing their pulpwood receipts by state and county. Their cooperation is gratefully acknowledged. Thanks are due also to Ray Pfeifer, Forest Survey Coordinator, Michigan Department of Conservation, for collecting data for the Michigan pulpmills. Robert Knutson, North Central Forest Experiment Station, coordinated the computing of the pulpmill data.

PART I. IN THE LAKE STATES

HIGHLIGHTS

Pulpwood production[1] reached a peak of 4,280,000 cords in 1966 in the Lake States, 17 percent above the previous record cut in 1964. Aspen roundwood output was 418,000 cords more than in 1965. Increased logging mechanization, a better logging season, low mill inventories, and higher pulpwood prices were major reasons for the record pulpwood harvest. However, the scarcity of woods labor continued.

Lake States pulpmills consumed 4,768,000 cords of wood in 1966, 741,000 cords more than in 1965. Demand for pulpwood in the Lake States rose because national economic activity was at a high level, the U.S. population continued to expand and find new uses for fiber products, and additions were made to regional pulping capacity.

Production Advanced Nearly One-fifth from 1965

In 1966, pulpwood produced in the Lake States was 644,000 cords greater than in 1965. Ninety-six percent was roundwood; the remainder was residue from local wood-using plants. Most of the residue was delivered to pulpmills as chips.

All major pulping species except spruce participated in the production gains. Besides the large increase in aspen cut (418,000 cords), pine cutting was up 110,000 cords, hemlock 44,000, and balsam fir 27,000 cords above 1965. The cut of maples, oaks, and other dense hardwoods was 79,000 cords higher.

Only 32,000 cords were exported to mills outside the Lake States, and 14,000 of these were wood residues from sawmills and veneer mills.

One-tenth more of the 1966 aspen harvest was rough wood (i.e., delivered with bark to the mills) than in 1965. The delivered mill price differential for rough and peeled aspen averaged about $10 per cord[2] in Wisconsin and about $6 per cord[3] in Minnesota. The continuing scarcity of woods labor

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[1] *"Production" is "the harvest of pulpwood from timber lands," whereas "consumption" (discussed in later sections) is "the utilization of pulpwood by mills."*

Note: The author is a Market Analyst on the staff of the North Central Forest Experiment Station. He is headquartered at the Station's main office in St. Paul, Minn., which is maintained in cooperation with the University of Minnesota.

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[2] *University of Wisconsin Extension Service, Wisconsin Forest Products Price Review, 8 pp. 1967.*

[3] *Minnesota Forest Products Marketing and Pricing Review, 8 pp. 1967.*

and the consequent high price of peeled aspen apparently was a major cause of the shift away from peeled aspen. Almost two-thirds of the Minnesota harvest and three-fifths of the Michigan harvest was rough aspen (fig. 1). Wisconsin loggers peeled 61 percent of the aspen cut in 1966 for pulpwood. A year earlier they were peeling 71 percent.

Other species were mostly delivered as rough wood to the pulpmills.

Consumption at New High

Forty-eight Lake States mills processed 4¾ million cords of pulpwood in 1966 compared with 4 million cords in 1965. Aspen, pine, and spruce accounted for 79 percent of all roundwood consumed. From 1965, pulpwood receipts rose by 429,000 cords of aspen, 95,000 cords of pine, and 84,000 cords of hardwood. All but six Lake States plants used aspen (table 1). Sawmills sold their residues to several more pulpmills in 1966 than in the previous year.

Spruce procurement by regional mills shifted towards Canada. Canadian forests supplied 65,000 more cords of spruce than in 1965, and Lake States forests supplied 45,000 fewer cords. Minnesota mills received 60,000 of these additional cords from Canada.

Wisconsin mills imported 92,000 cords of lodgepole and ponderosa pine pulpwood from Montana, South Dakota, Idaho, Wyoming, Colorado, and Nebraska.

Total pulpwood imports were 520,000 cords, 86,000 cords ahead of 1965 (table 2). Exports declined by one-fourth to 32,000 cords.

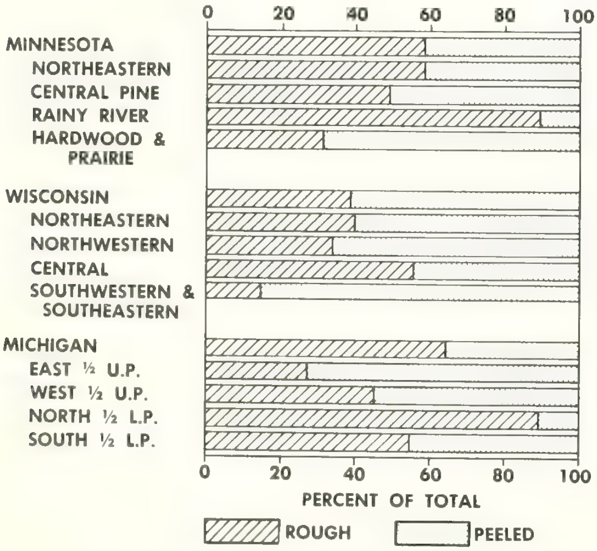

FIGURE 1. — Percent of rough and peeled aspen production of roundwood, by State and Forest Survey District, 1966.

TABLE 1. — *Number of plants using the differ species of wood for pulping in 1966*

Species and kind of material	Lake States	Minn.	Wis.	Mi
Aspen	42	9	25	
Balsam fir	23	6	11	
Birch	7	1	5	
Hemlock	9	-	6	
Pine	14	3	5	
Spruce	27	5	16	
Tamarack	4	2	2	
Misc. hardwoods	16	2	8	
Wood chips	10	2	4	
Slabwood and other residue	5	1	3	
Total plants	48	9	29	1

TABLE 2. — *Pulpwood exports and imports for t Lake States, 1966 (Thousand standard cords, unpeeled)*

Species	Exports	Imports	Net exports (imports)
Aspen	-	28	(28)
Balsam fir	-	20	(20)
Pine	-	101	(101)
Spruce	10	279	(269)
Mixed hardwoods	8	1	7
Residues, softwood	7	89	(82)
Residues, hardwood	7	2	5
Total	32	520	(488)

Regional Mill Capacity Approaches 10,000 Tons Per Day

Half of the daily regional mill capacity 9,530 tons[4] is in Wisconsin (table 3). Mechanic fiber separation is most used, but the sulfi process still accounts for one-fourth of the regio al capacity.

Actual and potential publicized mill constru tion and expansions indicate a rise in the region pulping capabilities of 10 percent during the ne 3 years. Most of the new capacity will use tl kraft (sulfate) process. At least two sulfite mil are expected to close and be replaced by kra facilities. All three States should participate in tl expansion.

Review of Pulpwood Production by States, 1966

Of the 1966 harvest, Michigan produced 37 pe cent, Wisconsin 36 percent, and Minnesota 27 pe cent.

Figures 2 and 3 show the amount of roundwoo cut relative to commercial forest area by count

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[4] *Excludes two mills in Wisconsin for which data ar not available.*

TABLE 3. — *Active woodpulp mills in the Lake States, by location, type of pulp produced, and capacity, 1966*

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Minnesota:						
Blandin Paper Co	Grand Rapids	200	--	--	200	--
Hennepin Paper Co	Little Falls	65	--	--	65	--
Boise Cascade Corp	International Falls	755	180	125	450	--
Northwest Paper Co., The	Cloquet	400	115	285	--	--
Nu-Ply Corp	Bemidji	75	--	--	75	--
St. Regis Paper Co	Sartell	125	--	--	125	--
Superwood Corp	Duluth	240	--	--	240	--
Waldorf Paper Products Co	St. Paul	275	--	--	--	275
Wood Conversion Co	Cloquet	350	--	--	350	--
Total	9 plants	2,485	295	410	1,505	275
Wisconsin:						
American Can Co	Green Bay	270	155	--	115	--
American Can Co	Rothschild	170	170	--	--	--
Badger Paper Mills, Inc	Peshtigo	90	90	--	--	--
Combined Locks Paper Co	Combined Locks	50	--	--	50	--
Consolidated Papers, Inc	Appleton	155	155	--	--	--
Consolidated Papers, Inc	Stevens Point	100	--	--	100	--
Consolidated Papers, Inc	Wisconsin Rapids	515	215	--	300	--
St. Regis Paper Co	Cornell	50	--	--	50	--
Fort Howard Paper Co	Green Bay	40	--	--	40	--
Green Bay Packaging, Inc	Green Bay	220	--	--	--	220
Kansas City Star Co	Park Falls	115	115	--	--	--
Kimberly-Clark Corp	Kimberly	280	130	--	150	--
Kimberly-Clark Corp	Niagara	275	125	--	150	--
Mosinee Paper Mills Co	Mosinee	200	--	200	--	--
Nekoosa-Edwards Paper Co	Nekoosa	310	--	310	--	--
Nekoosa-Edwards Paper Co	Port Edwards	200	200	--	--	--
Owens-Illinois	Tomahawk	525	--	--	--	525
Peavey Paper Mills, Inc	Ladysmith	30	--	--	30	--
Procter & Gamble Co	Green Bay	2/	2/	--	2/	--
Procter & Gamble Co	Little Rapids	2/	--	--	2/	--
Scott Paper Co	Marinette	50	50	--	--	--
Scott Paper Co	Oconto Falls	110	110	--	--	--
St. Regis Paper Co	Rhinelander	140	100	--	--	40
Sterling Pulp & Paper Co	Eau Claire	175	100	--	75	--
Superior Fiber Products Co	Superior	140	--	--	140	--
Thilmany Pulp & Paper Co	Kaukauna	300	--	300	--	--
Tomahawk Pulp Co., Inc	Tomahawk	50	--	--	50	--
Wausau Paper Mills Co	Brokaw	145	145	--	--	--
Wisconsin Wood Products, Inc	Phillips	50	--	--	50	--
Total	29 plants	4,755	1,860	810	1,300	785
Michigan:						
Abitibi Corp	Alpena	300	--	--	300	--
Celotex Corp	L'Anse	270	--	--	270	--
Hoerner Boxes, Inc	Ontonagon	400	--	150	--	250
Manistique Pulp & Paper Co	Manistique	90	--	--	90	--
Mead Corp, The	Groos	100	--	--	100	--
Menasha Corp	Ostego	150	--	--	--	150
Packaging Corp. of America	Filer City	565	--	165	--	400
Scott Paper Co	Detroit	170	170	--	--	--
Scott Paper Co	Menominee	20	--	--	20	--
Warren Co., S.D	Muskegon	225	--	225	--	--
Total	10 plants	2,290	170	540	780	800
All States	48 plants	9,530	2,325	1,760	3,585	1,860

1/ Lockwoods Directory of the Paper and Allied Industries-1967, and 1967 Directory of the Forest Products Industry.
2/ Capacity not available.

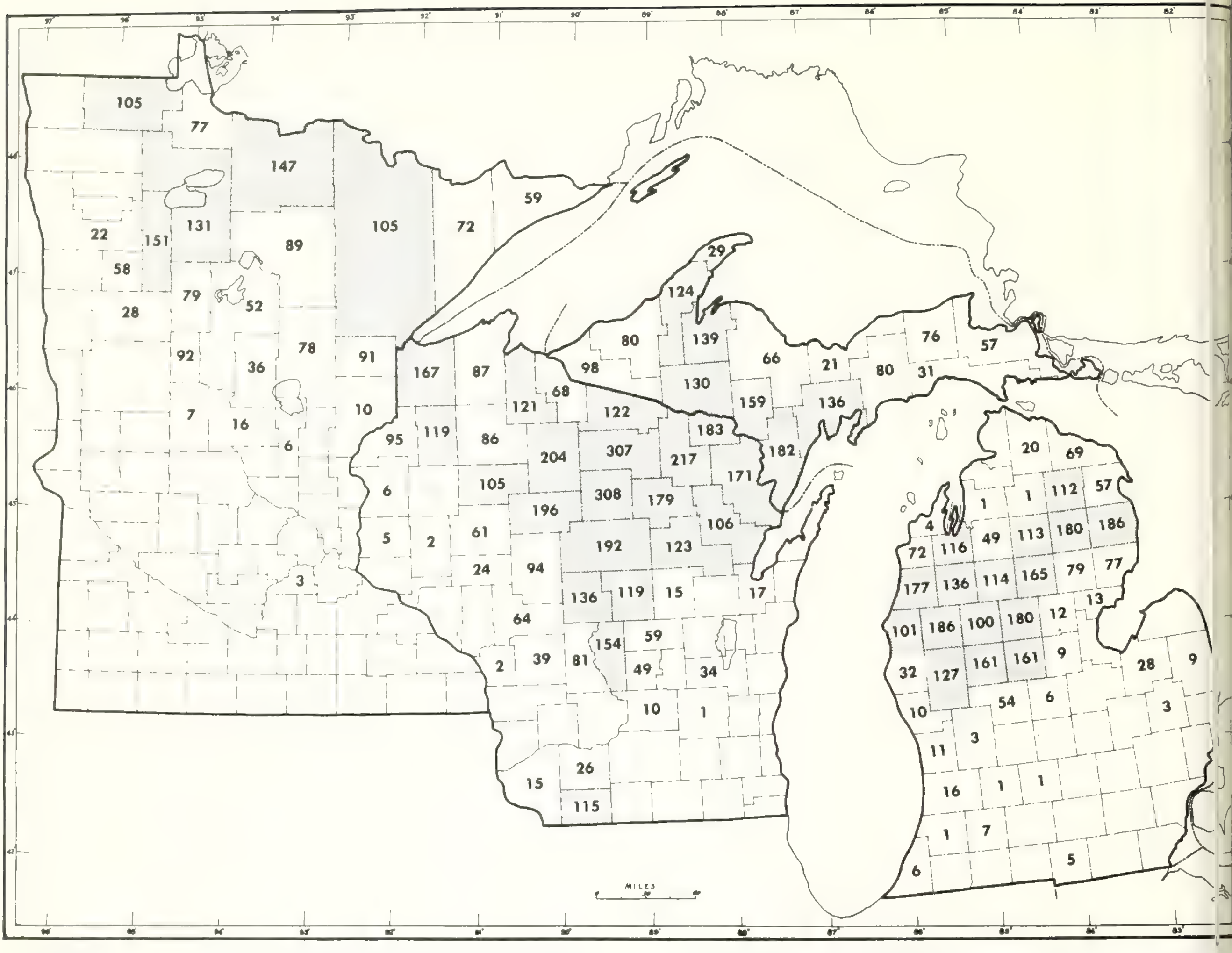

Figure 2. — Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in the principal pulpwood-producing counties. 1966. Cross-hatching shows counties that supplied 100 or more cords of pul wood per 1,000 acres of stocked commercial fore land.

and relative to merchantable timber volume by Forest Survey District.

Wisconsin boosts harvest 283,000 cords. — Strong demand for pulpwood at resident mills gave impetus to the record Wisconsin cut in 1966. These mills used all but 2 percent of the 1,536,000 cords harvested. The increase in cut came primarily from northeastern and northwestern Wisconsin. Aspen represented 71 percent of the additional harvest. Hardwood production climbed 44,000 cords after declining for 2 years. Imports account for 43 percent of the pulpwood used in Wisconsin, a drop of 2 percent in the year.

For the first time, pulpwood cut in Oneida and Lincoln Counties was above 300 cords per thousand acres of stocked commercial forest land (fig. 2). Previously cutting had never approached this figure in the region. If competition for pul wood continues to increase, more intensive fore management may be necessary to sustain the cutting rates. Oneida, Forest, and Lincoln Counti cut the most pulpwood — 147,000, 109,000 ar 100,000 cords, respectively.

Michigan cut 215,000 cords above 5-year ave age. — Michigan loggers produced 1,570,000 cor of pulpwood, but only 57 percent was retained i the State. Wisconsin mills received 666,000 cor from Michigan, all from the Upper Peninsula.

Top-producing counties were Menomin (93,000 cords), Iron (88,000 cords), and Del (84,000 cords). Output from Clare County jumpe 122 percent to 40,000 cords.

Michigan sawmills and veneer mills supplie

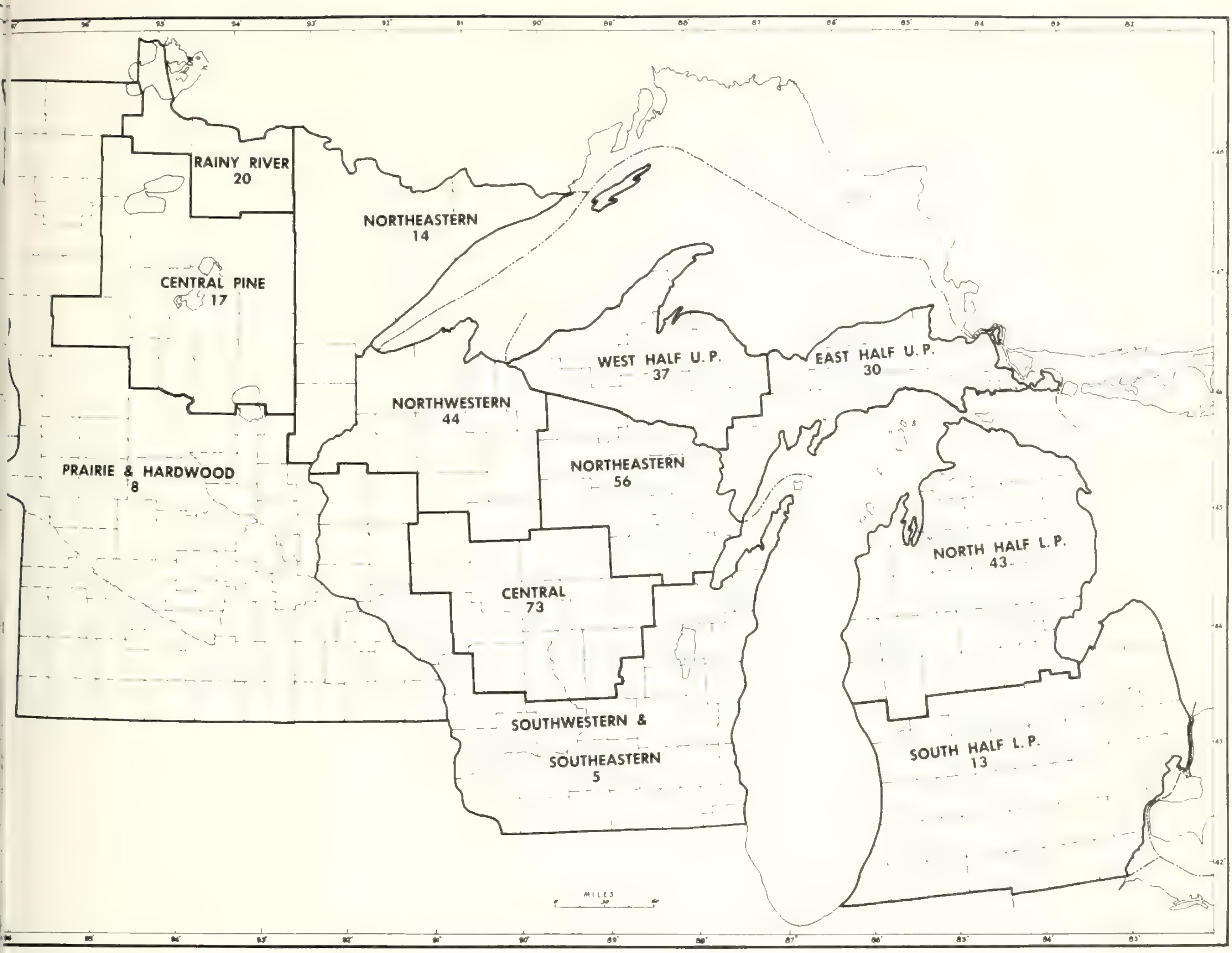

FIGURE 3. — Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species, by Forest Survey District, 1966. The heavy lines delineate the boundaries of the Forest Survey Districts in each state.

75,000 cords of residue to pulpmills, 47 percent more than in 1965.

Minnesota harvest up 15 percent. — Minnesota pulpwood output expanded to 1,174,000 cords in 1966 compared to 1,018,000 cords in 1965. Three-fourths of the 156,000-cord increase came from the Central Pine District. Resident mills used most of the additional cut; Wisconsin's share was only 34,000 cords. Large gains occurred in aspen and jack pine production, but spruce production declined 66,000 cords. On the average from July to December 1966, prices (f.o.b. cars) for rough spruce pulpwood in Minnesota were more than twice as high as rough aspen prices and about 50 percent above rough pine prices.[5] These large price differences may partially explain the shift in demand from spruce toward more intensive cutting of aspen and pine.

Counties increasing their cut significantly included St. Louis, Aitkin, Beltrami, and Itasca. St. Louis is the first county in the Lake States to have an annual harvest exceeding 300,000 cords.

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[5] *See footnote 3.*

THE PINE PULPWOOD STORY

Jack pine, the most common of the three pines in the Lake States, is the second most important regional pulping species. From a timber production standpoint, jack pine is a particularly desirable pulpwood species because its rate of growth is rapid during the first 30 or 40 years, and it is more adaptable to propagation in some areas than other conifers. Jack pine is important in the manufacture of kraft papers and boards.

Pine Production

Prior to 1920, jack pine was rarely used for any products. In 1966, pine cut for pulpwood in the region was 721,000 cords or 98,000 cords above the previous record high in 1959. Nearly all of this was jack pine, but small quantities of red and white pine were mixed in. Since 1947, production has averaged 485,000 cords annually. During the later forties, the annual average cut was close to this 20-year average, then declined in the earl fifties, and has risen intermittently since ther The average annual harvests for 5-year interval beginning in 1947 have been as follows:

	Thousand cords
1947-51	433
1952-56	383
1957-61	518
1962-66	605

As the current and proposed kraft mill expan sions are completed in the Lake States, native pin cutting is expected to increase accordingly.

Except for 1965, Minnesota has always led th Lake States in harvesting pine pulpwood. Howeve all three states are now important producers. Th peak Minnesota output of 340,000 cords occurre in 1951 and since then has generally ranged fron 200,000 to 250,000 cords yearly (fig. 4). A large

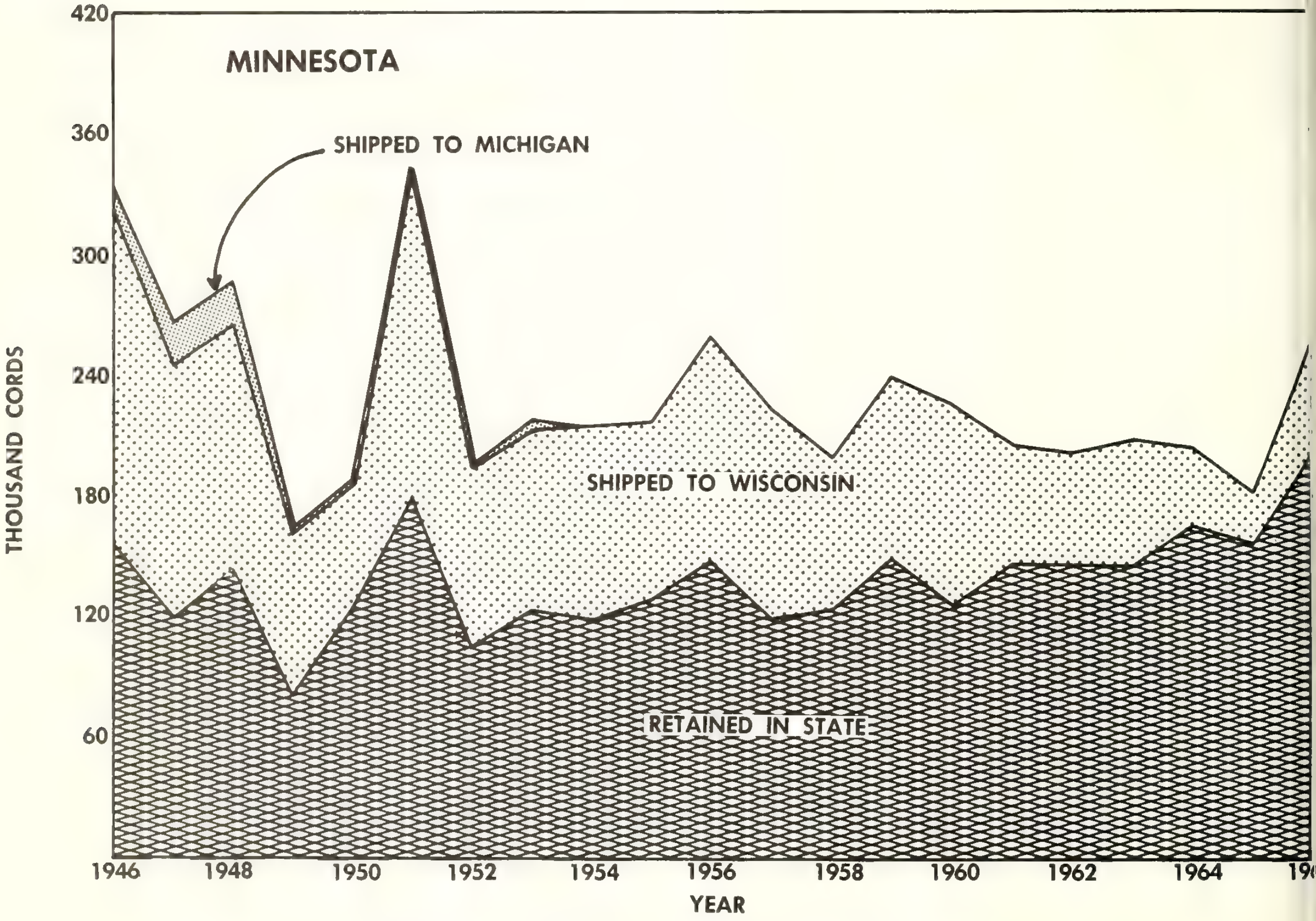


FIGURE 4. — The trend in pine pulpwood production in Minnesota and its destination by State, 1946-1966.

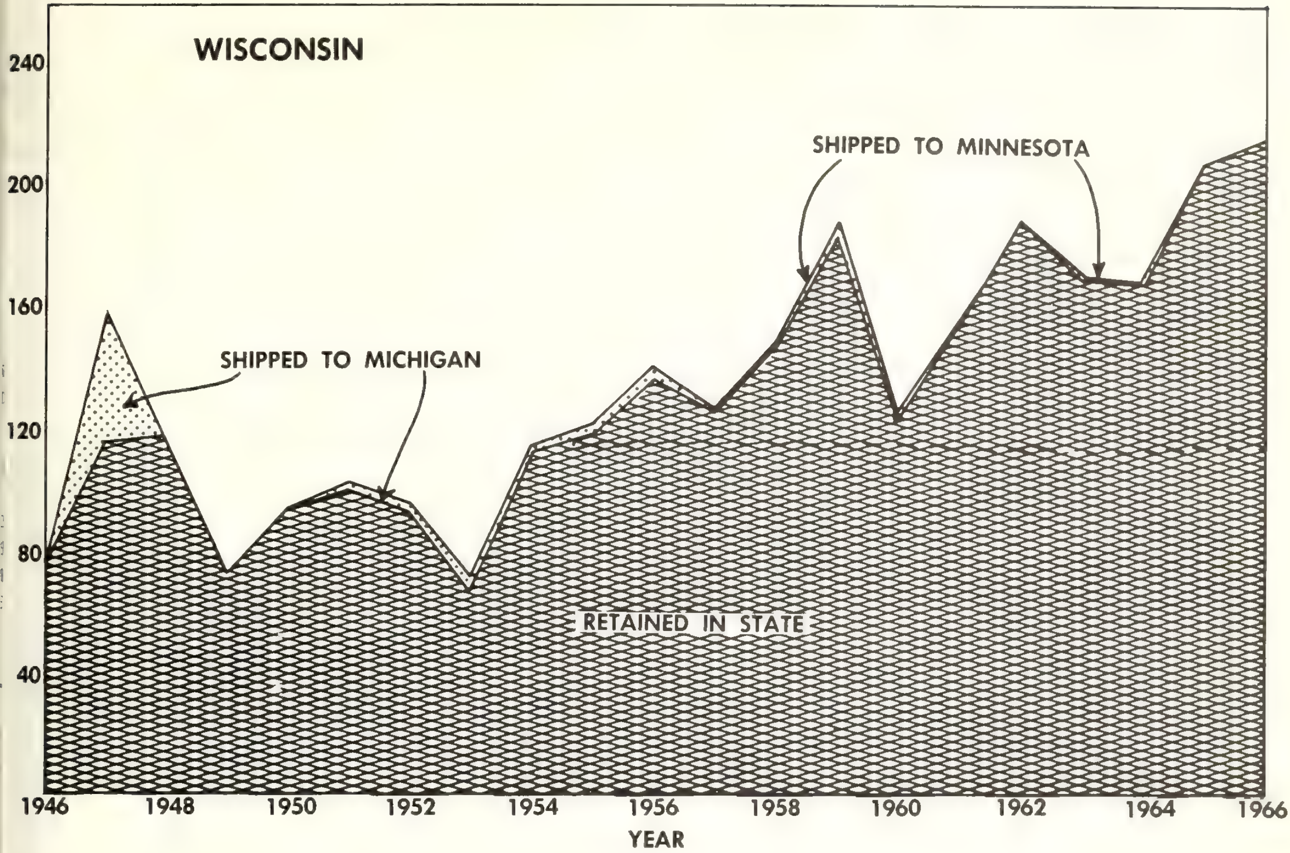


FIGURE 5. — The trend in pine pulpwood production in Wisconsin and its destination by State, 1946-1966. From 1954 on, all exports of pine pulpwood went to Minnesota whereas previously they had been shipped to Michigan.

share of the cut is being retained in Minnesota than a few years ago; Wisconsin receives the rest. Two counties, St. Louis and Lake, accounted for more than half the Minnesota pine output in 1966.

From a low of 71,000 cords in 1953, Wisconsin's annual pine pulpwood cut has been trending upward to the 215,000-cord record in 1966 (fig. 5). Virtually all of the wood is retained in Wisconsin. Northwestern Wisconsin is now the main pine pulpwood producing area; it outstripped the Central District in 1965. Important producing counties are Douglas, Burnett, Oneida, and Washburn.

Michigan's pine pulpwood harvest has rebounded sharply from a low point of 38,000 cords in 1955 to 250,000 cords in 1966 (fig. 6). The expanding demand for pine in Wisconsin mills has been a prime stimulant for greater logging in Michigan. Between 1962-66, 47 percent of pine pulpwood cut in Michigan was shipped to Wisconsin. Northern Lower Michigan cutters produce about one-half of Michigan's pine pulpwood. Marquette, Crawford, and Oscoda are top-producing counties.

Pine Consumption

Regional demand for pine pulpwood dropped precipitously from 1951 to 1954, then advanced periodically to three successive peaks (fig. 7). The 1966 peak was 823,000 cords — 326,000 cords above 1954. Consumption gains have been irregular for 21 years, each advance being no longer than 2 years.

Wisconsin's kraft pulpmills comprise 46 percent of the Lake States kraft capacity and, correspondingly, during the last 3 years Wisconsin mills have required 55 percent of all pine roundwood going to regional pulpmills. Half or more of the pine needed is imported from other States and Canada. Since 1953, pine consumption in Wisconsin has progressed irregularly upward. Five Wisconsin mills are now using pine.

During the last 20 years, Minnesota consumption of pine topped out in 1951 and has fluctuated between 150,000 and 215,000 cords yearly since then. Consumption in recent years has been steady

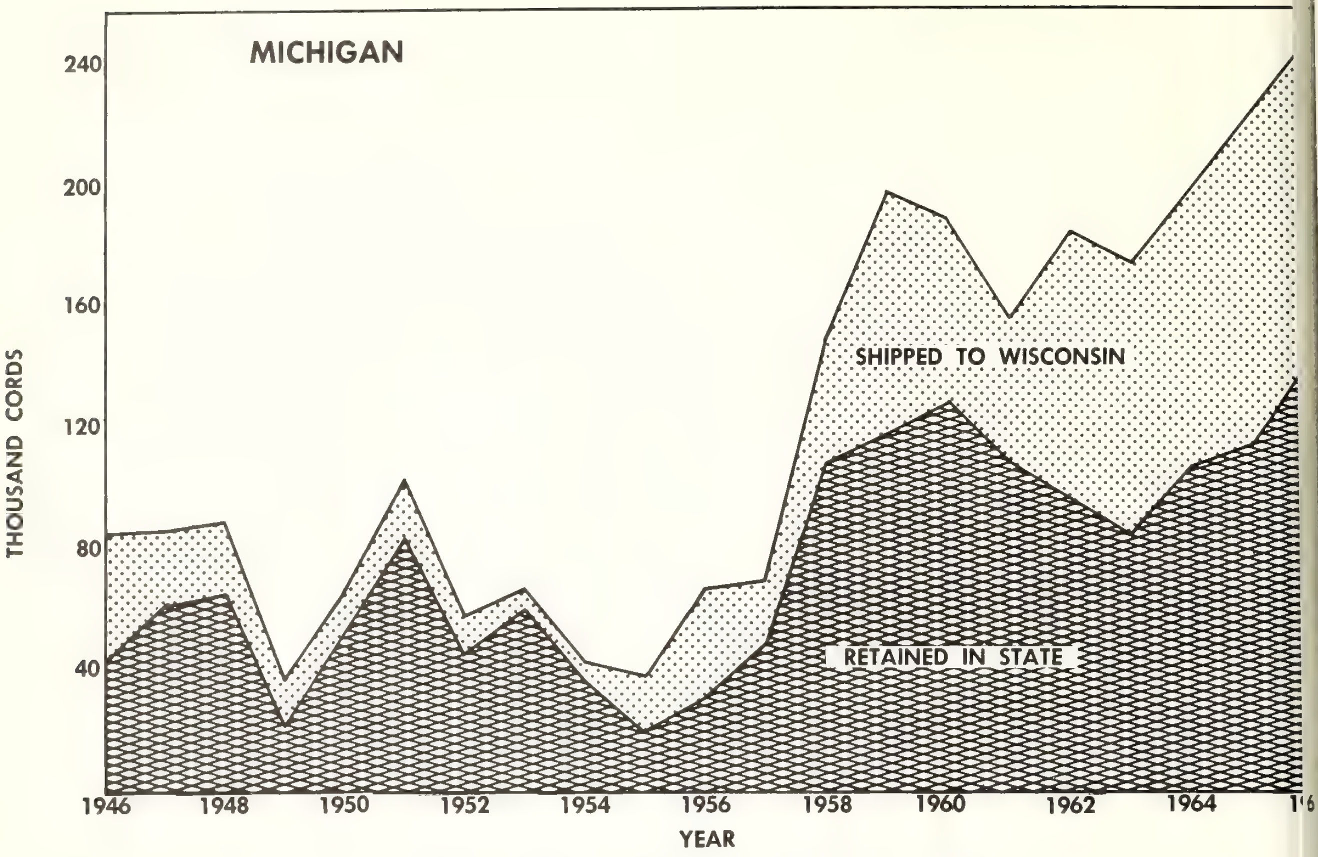


FIGURE 6. — The trend in pine pulpwood production in Michigan and its destination by State, 1946-1966.

at around 200,000 cords annually. Three mills used pine in 1966.

Six Michigan pulpmills used 143,000 cords of pine in 1966. Consumption in Michigan bottomed out in 1955 at 20,000 cords, advanced until 1960, declined for 3 years, and then advanced to the same level established 20 years ago. Thus, consumption has increased sixfold from 1955.

Lake States mills are obtaining a much larger share of their pine roundwood needs within the region than 15 years ago. As consumption of pine pulpwood has increased in the Lake States, ir ports of pine from Canada have decreased, and 1966 nearly disappeared (fig. 8). Canadian ir ports dropped from 59,000 cords in 1965 to 10,0 cords in 1966, the lowest point in 20 years, ar 150,000 cords below the high recorded in 195 Pine pulpwood imports from Western States ha zigzagged up and down for 10 years, but, overal have shown no trend. Maturing Lake States pir plantations are supplying more of the mill requir ments than formerly, a trend that will probab continue.

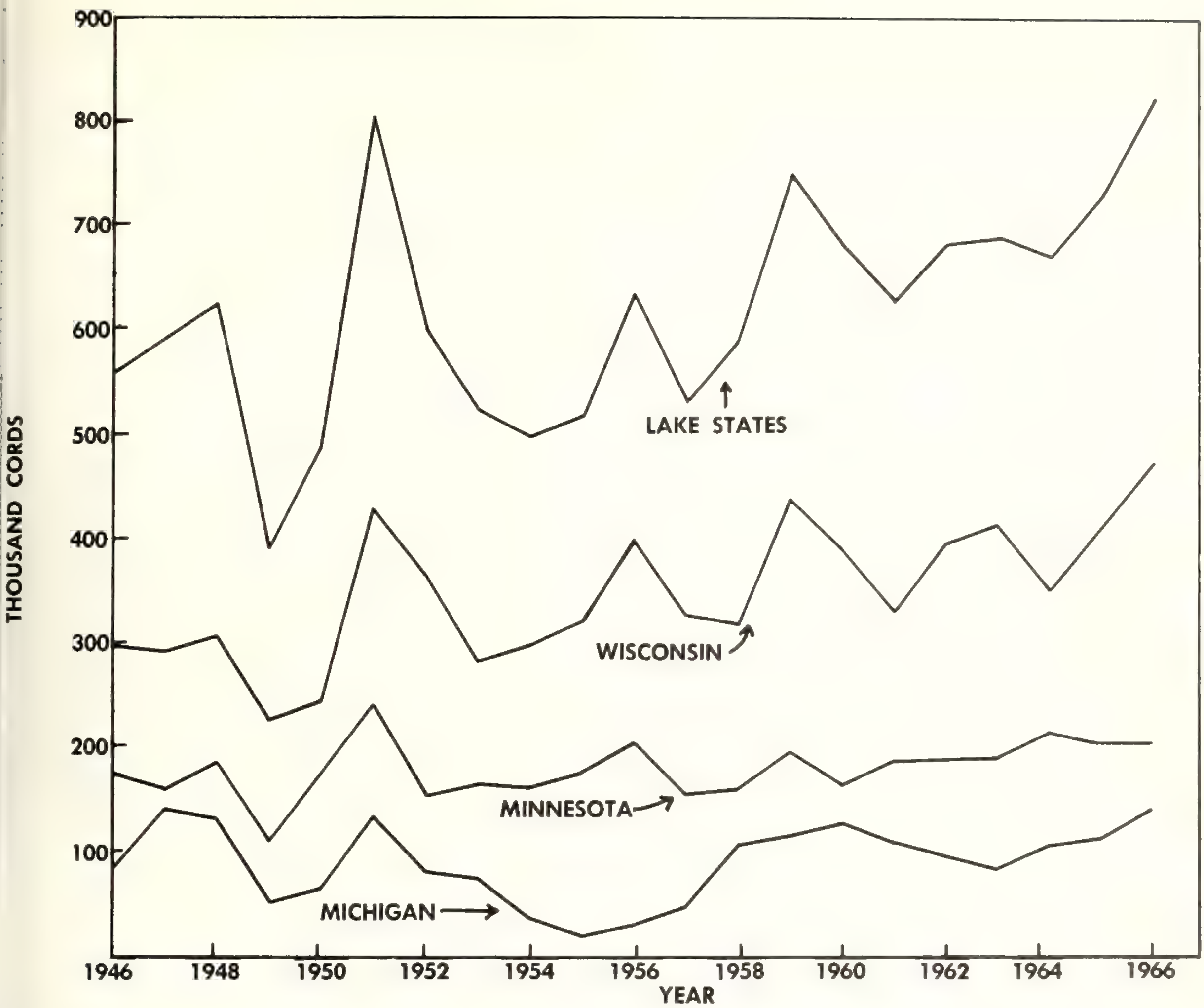


FIGURE 7. — The trend in use of pine pulpwood in the Lake States by State, 1946-1966.

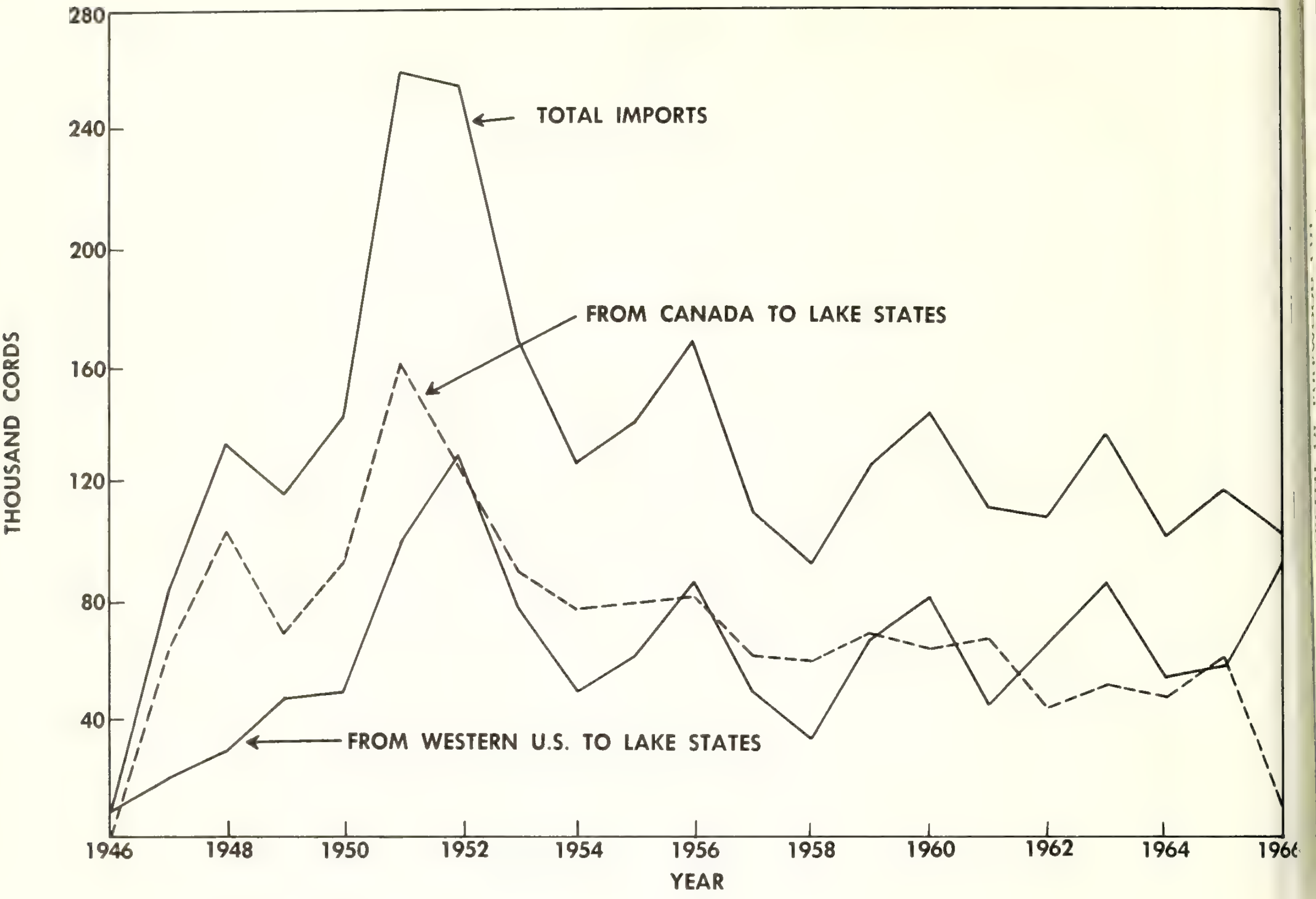
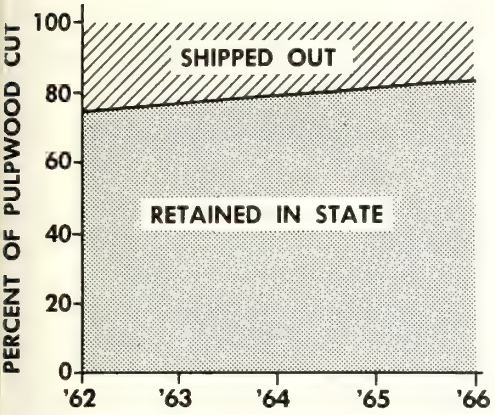


Figure 8. — The trend in use of imported pine pulpwood from Western United States and Canada, 1946-1966.

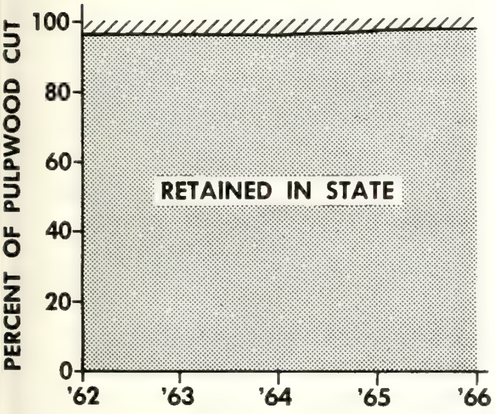
LAKE STATES PULPWOOD PRODUCTION, BY STATE OF ORIGIN AND DESTINATION, 1962 - 1966



MINNESOTA

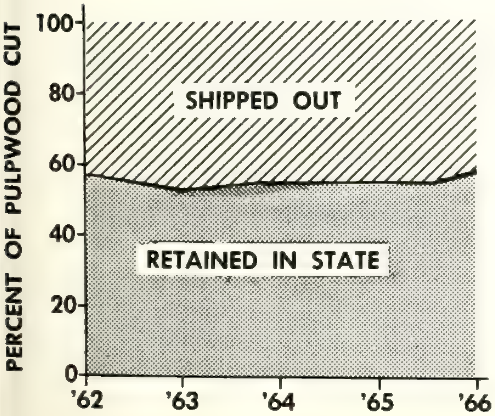
Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1962	979	753	216	1	9
1963	1,063	828	221	-	14
1964	1,062	856	193	-	13
1965	1,018	842	159	-	17
1966	1,174	970	193	*	11
5-year average	1,059	850	196	*	13

* Less than 500 cords.



WISCONSIN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1962	1,140	15	1,114	1	10
1963	1,302	20	1,262	2	18
1964	1,244	19	1,207	2	16
1965	1,253	8	1,225	1	19
1966	1,536	13	1,501	3	19
5-year average	1,295	15	1,262	2	16



MICHIGAN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1962	1,223	-	540	677	6
1963	1,297	-	633	664	-
1964	1,321	-	588	730	3
1965	1,365	-	608	750	7
1966	1,570	1	666	901	2
5-year average	1,355	*	607	745	3

* Less than 500 cords.

LAKE STATES PULPWOOD PRODUCTION, BY FOREST SURVEY DISTRICT AND DESTINATION BY STATE, 1966

MINNESOTA

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
Northeastern	449	331	117	*	1
Central Pine	449	385	64	-	*
Rainy River	237	221	6	-	10
Hardwood & Prairie	39	33	6	-	-
Total	1,174	970	193	*	11

WISCONSIN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
Northeastern	736	-	729	*	7
Northwestern	543	4	536	3	-
Central	222	-	222	-	*
Southeastern & Southwestern	35	9	14	-	12
Total	1,536	13	1,501	3	19

MICHIGAN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
	(Thousand standard cords, roughwood basis)				
E. ½ Up. Pen.	350	-	252	98	-
W. ½ Up. Pen.	521	1	414	106	-
N. ½ Low. Pen.	644	-	-	644	-
S. ½ Low. Pen.	55	-	-	53	2
Total	1,570	1	666	901	2

* Less than 500 cords.

LAKE STATES PULPWOOD PRODUCTION, BY SPECIES, STATE, AND FOREST SURVEY DISTRICT, 1962 - 1966

(Thousand standard cords, roughwood basis)

ASPEN

State and district	Annual production				
	1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	170	181	176	177	205
Central Pine	146	150	172	186	272
Rainy River	83	94	91	96	123
Prairie & Hardwood	7	8	12	9	12
Total	406	433	451	468	612
WISCONSIN:					
Northeastern	301	321	332	341	449
Northwestern	210	219	208	220	298
Central	54	71	61	45	61
Southeastern & Southwestern	7	2	2	2	2
Total	572	613	603	608	810
MICHIGAN:					
E. ½ Up. Pen.	96	122	112	142	156
W. ½ Up. Pen.	174	203	206	207	222
N. ½ Low. Pen.	305	314	332	341	388
S. ½ Low. Pen.	26	23	25	14	10
Total	601	662	675	704	776
Lake States	1,579	1,708	1,729	1,780	2,198

* Less than 500 cords.

BALSAM FIR

State and district	Annual production				
	1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	38	31	26	22	20
Central Pine	40	38	32	23	35
Rainy River	32	33	31	28	25
Prairie & Hardwood	-	*	*	*	-
Total	110	102	89	73	80
WISCONSIN:					
Northeastern	24	33	27	25	28
Northwestern	22	27	29	24	26
Central	*	1	1	1	1
Southeastern & Southwestern	*	*	*	-	-
Total	46	61	57	50	55
MICHIGAN:					
E. ½ Up. Pen.	56	63	47	41	48
W. ½ Up. Pen.	44	50	33	30	37
N. ½ Low. Pen.	4	8	4	2	3
S. ½ Low. Pen.	-	-	-	-	-
Total	104	121	84	73	88
Lake States	260	284	230	196	223

(Cont'd on next page)

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

JACK PINE[1]

State and district	Annual production				
	1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	126	136	129	101	138
Central Pine	53	50	49	56	85
Rainy River	13	14	17	12	15
Prairie & Hardwood	9	8	9	12	18
Total	201	208	204	181	256
WISCONSIN:					
Northeastern	42	45	48	57	58
Northwestern	71	53	51	76	92
Central	70	69	68	72	64
Southeastern & Southwestern	5	3	1	1	1
Total	188	170	168	206	215
MICHIGAN:					
E. ½ Up. Pen.	61	54	51	66	63
W. ½ Up. Pen.	29	36	40	47	47
N. ½ Low. Pen.	93	84	106	110	138
S. ½ Low. Pen.	1	*	1	1	2
Total	184	174	198	224	250
Lake States	573	552	570	611	721

SPRUCE

State and district	Annual production				
	1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	114	125	118	106	78
Central Pine	40	39	50	38	31
Rainy River	63	90	88	92	61
Prairie & Hardwood	*	1	1	2	2
Total	217	255	257	238	172
WISCONSIN:					
Northeastern	8	14	13	10	14
Northwestern	6	5	6	5	4
Central	1	*	*	*	*
Southeastern & Southwestern	*	*	*	-	-
Total	15	19	19	15	18
MICHIGAN:					
E. ½ Up. Pen.	41	37	33	28	31
W. ½ Up. Pen.	41	46	35	36	42
N. ½ Low. Pen.	4	5	3	1	1
S. ½ Low. Pen.	-	-	-	-	-
Total	86	88	71	65	74
Lake States	318	362	347	318	264

(Cont'd on next page)

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[1] Includes small quantity of red and white pine.

* Less than 500 cords.

(Pulpwood production cont'd)

(Thousand standard cords, roughwood basis)

BIRCH

State and district	Annual production 1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	*	*	-	-	-
Central Pine	2	*	*	*	1
Rainy River	-	*	-	-	-
Prairie & Hardwood	-	*	-	-	-
Total	2	*	*	*	1
WISCONSIN:					
Northeastern	4	8	8	5	9
Northwestern	31	36	28	17	26
Central	6	6	5	2	4
Southeastern & Southwestern	-	*	*	*	-
Total	41	50	41	24	39
MICHIGAN:					
E. ½ Up. Pen.	5	11	14	5	3
W. ½ Up. Pen.	3	4	6	1	2
N. ½ Low. Pen.	13	8	18	26	8
S. ½ Low. Pen.	-	-	-	-	-
Total	21	23	38	32	13
Lake States	64	73	79	56	53

HEMLOCK

State and district	Annual production 1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	-	-	-	-	-
Central Pine	-	-	-	-	-
Rainy River	-	-	-	-	-
Prairie & Hardwood	-	-	-	-	-
Total	-	-	-	-	-
WISCONSIN:					
Northeastern	21	25	27	37	48
Northwestern	18	24	22	21	18
Central	3	3	3	2	3
Southeastern & Southwestern	*	*	-	-	-
Total	42	52	52	60	69
MICHIGAN:					
E. ½ Up. Pen.	3	6	10	9	21
W. ½ Up. Pen.	54	56	49	55	78
N. ½ Low. Pen.	-	-	-	-	-
S. ½ Low. Pen.	-	*	-	-	-
Total	57	62	59	64	99
Lake States	99	114	111	124	168

* Less than 500 cords.

(Cont'd on next page)

(Pulpwood production cont'd)

TAMARACK

(Thousand standard cords, roughwood basis)

State and district	Annual production 1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	6	9	7	5	1
Central Pine	3	4	5	6	6
Rainy River	-	-	-	-	*
Prairie & Hardwood	-	*	*	1	*
Total	9	13	12	12	7
WISCONSIN:					
Northeastern	2	1	1	1	1
Northwestern	4	5	3	3	2
Central	*	*	*	-	*
Southeastern & Southwestern	*	*	-	*	-
Total	6	6	4	4	3
MICHIGAN:					
E. ½ Up. Pen.	3	1	2	2	1
W. ½ Up. Pen.	1	2	1	1	*
N. ½ Low. Pen.	-	-	-	*	-
S. ½ Low. Pen.	-	-	-	-	-
Total	4	3	3	3	1
Lake States	19	22	19	19	11

* Less than 500 cords.

MISC. HARDWOODS

State and district	Annual production 1962	1963	1964	1965	1966
MINNESOTA:					
Northeastern	4	4	3	4	4
Central Pine	21	35	29	24	13
Rainy River	9	9	9	10	13
Prairie & Hardwood	*	3	3	3	1
Total	34	51	44	41	31
WISCONSIN:					
Northeastern	46	50	44	56	80
Northwestern	67	100	93	56	70
Central	69	74	75	77	84
Southeastern & Southwestern	6	9	12	9	8
Total	188	233	224	198	242
MICHIGAN:					
E. ½ Up. Pen.	13	2	7	8	16
W. ½ Up. Pen.	58	54	60	63	70
N. ½ Low. Pen.	67	70	76	75	103
S. ½ Low. Pen.	6	5	3	3	5
Total	144	131	146	149	194
Lake States	366	415	414	388	467

(Cont'd on next page)

(Pulpwood production cont'd)

RESIDUE & CHIPS[1]

State and district	Annual production 1962	1963	1964	1965	1966
	(Thousand standard cords, roughwood basis)				
MINNESOTA:					
Northeastern	-	-	-	1	3
Central Pine	-	-	2	2	6
Rainy River	-	-	-	-	-
Prairie & Hardwood	*	1	3	2	6
Total	*	1	5	5	15
WISCONSIN:					
Northeastern	18	55	43	51	49
Northwestern	14	19	15	8	7
Central	8	19	12	6	5
Southeastern & Southwestern	2	5	6	23	24
Total	42	98	76	88	85
MICHIGAN:					
E. ½ Up. Pen.	*	8	6	5	11
W. ½ Up. Pen.	22	25	38	26	23
N. ½ Low. Pen.	-	-	-	-	3
S. ½ Low. Pen.	-	-	3	20	38
Total	22	33	47	51	75
Lake States	64	132	128	144	175

ALL SPECIES[2]

State and district	Annual production 1962	1963	1964	1965	1966
	(Thousand standard cords, roughwood basis)				
MINNESOTA:					
Northeastern	458	486	459	416	449
Central Pine	305	316	339	335	449
Rainy River	200	240	236	238	237
Prairie & Hardwood	16	21	28	29	39
Total	979	1,063	1,062	1,018	1,174
WISCONSIN:					
Northeastern	466	552	543	583	736
Northwestern	443	488	455	430	543
Central	211	243	225	205	222
Southeastern & Southwestern	20	19	21	35	35
Total	1,140	1,302	1,244	1,253	1,536
MICHIGAN:					
E. ½ Up. Pen.	278	304	282	306	350
W. ½ Up. Pen.	426	476	468	466	521
N. ½ Low. Pen.	486	489	539	555	644
S. ½ Low. Pen.	33	28	32	38	55
Total	1,223	1,297	1,321	1,365	1,570
Lake States	3,342	3,662	3,627	3,636	4,280

[1] Not reported by district. Prorated on basis of most recent lumber output figures.

[2] Including residues and chips.

* Less than 500 cords.

LAKE STATES PULPWOOD PRODUCTION BY COUNTY AND SPECIES, 1966

WISCONSIN

District & county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[2]
	(Thousand standard cords, roughwood basis)									
NORTHEASTERN:										
Florence	45	38	1	*	3	1	1	-	1	
Forest	109	74	9	*	13	2	3	*	8	
Langlade	62	41	1	1	1	3	1	*	14	
Lincoln	100	63	3	2	3	4	1	*	24	
Marinette	92	61	4	-	5	13	4	*	5	
Oconto	39	33	1	-	1	2	*	-	2	
Oneida	147	94	7	3	2	20	3	1	17	
Shawano[3]	44	20	1	*	17	1	*	*	5	
Vilas	49	25	1	3	3	12	1	*	4	
Total	736	449	28	9	48	58	14	1	80	49
NORTHWESTERN:										
Ashland	59	39	9	2	3	1	1	*	4	
Bayfield	63	40	2	5	1	13	*	-	2	
Burnett	27	5	-	*	-	22	*	*	*	
Douglas	85	57	1	*	*	26	1	*	*	
Iron	25	16	3	1	1	2	*	-	2	
Price	98	53	6	10	3	2	1	1	22	
Rusk	32	14	*	1	1	-	*	*	16	
Sawyer	49	22	3	6	3	6	*	*	9	
Taylor	59	34	2	1	6	*	*	1	15	
Washburn	39	18	*	*	*	20	1	*	*	
Total	543	298	26	26	18	92	4	2	70	7
CENTRAL:										
Adams	31	2	-	-	-	15	-	-	14	
Chippewa	12	11	*	-	*	1	-	-	*	
Clark	24	11	*	*	*	1	-	-	12	
Eau Claire	3	1	-	-	*	2	-	-	-	
Jackson	19	1	-	-	-	15	-	*	3	
Juneau	18	4	-	-	-	11	-	-	3	
Marathon	57	22	1	4	3	1	*	-	26	
Marquette	3	*	-	-	*	*	-	-	3	
Monroe	9	*	-	-	-	8	-	*	1	
Portage	14	2	*	*	*	3	*	-	9	
Waupaca	2	1	*	*	*	*	-	-	1	
Waushara	5	*	*	-	*	3	-	-	2	
Wood	20	6	*	*	*	4	-	-	10	
Total	222	61	1	4	3	64	*	*	84	5

WISCONSIN (cont'd)

District & county 1/	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips 2/
	(Thousand standard cords, roughwood basis)									
SOUTHWESTERN:										
Barron	*	*	-	-	-	-	-	-	-	
Dunn	*	*	-	-	-	*	-	-	-	
Grant	3	-	-	-	-	-	-	-	3	
Iowa	2	-	-	-	-	-	-	-	2	
La Crosse	*	-	-	-	-	*	-	-	-	
La Fayette	2	-	-	-	-	-	-	-	2	
Polk	2	1	-	-	-	1	*	*	*	
Richland	*	-	-	-	-	*	-	-	-	
Sauk	*	-	-	-	-	*	-	-	-	
St. Croix	*	*	-	-	-	-	-	-	-	
Trempealeau	*	-	-	-	-	*	-	-	-	
Total	30	1	-	-	-	1	-	-	7	21
SOUTHEASTERN:										
Brown	*	*	-	-	-	*	-	-	*	
Columbia	1	*	-	-	-	*	-	-	1	
Dodge	*	-	-	-	-	-	-	-	*	
Fond du Lac	1	1	-	-	-	-	-	-	-	
Total	5	1	-	-	-	*	-	-	1	3
State total	1,536	810	55	39	69	215	18	3	242	85

1/ Includes only those counties that supplied pulpwood in 1966.

2/ County figures are not available.

3/ Includes Menominee County.

* Less than 500 cords.

MICHIGAN

District & county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[2]
(Thousand standard cords, roughwood basis)										
E. ½ UP. PEN.										
Alger	11	2	1	*	2	5	1	-	*	
Chippewa	43	14	3	*	1	19	5	-	1	
Delta	84	39	17	2	5	9	7	*	5	
Luce	40	11	4	*	8	11	4	-	2	
Mackinac	17	9	2	*	*	3	2	-	1	
Menominee	93	65	10	1	1	6	6	1	3	
Schoolcraft	51	16	11	*	4	10	6	*	4	
Total	350	156	48	3	21	63	31	1	16	11
W. ½ UP. PEN.										
Baraga	74	29	4	-	17	2	8	*	14	
Dickinson	71	49	5	*	2	8	5	*	2	
Gogebic	62	24	5	*	24	*	1	-	8	
Houghton	68	15	4	*	19	2	6	*	22	
Iron	88	54	5	1	5	3	9	*	11	
Keweenaw	6	*	4	-	-	-	2	-	-	
Marquette	72	21	9	1	1	31	9	*	*	
Ontonagon	57	30	1	*	10	1	2	*	13	
Total	521	222	37	2	78	47	42	*	70	23
N. ½ LOW.PEN.										
Alcona	59	47	*	3	-	3	*	-	6	
Alpena	12	8	1	1	-	*	1	-	1	
Antrim	*	*	-	-	-	*	-	-	-	
Arenac	1	1	-	-	-	-	-	-	*	
Bay	*	-	-	-	-	-	-	-	*	
Benzie	9	7	-	-	-	*	-	-	2	
Cheboygan	7	5	*	*	-	2	*	-	*	
Clare	40	37	-	-	-	*	-	-	3	
Crawford	33	5	-	-	-	26	-	-	2	
Gladwin	2	2	-	-	-	-	-	-	*	
Grand Traverse	18	11	-	-	-	5	-	-	2	
Iosco	18	4	*	*	-	14	-	-	*	
Isabella	15	15	-	-	-	*	-	-	*	
Kalkaska	13	7	*	-	-	6	*	-	*	
Lake	54	16	-	-	-	14	-	-	24	
Leelanau	*	*	-	-	-	*	-	-	*	
Manistee	38	11	-	-	-	3	-	-	24	
Mason	16	9	-	-	-	2	-	-	5	
Mecosta	23	19	-	-	-	*	-	-	4	
Midland	1	1	-	-	-	-	-	-	*	
Missaukee	25	19	-	-	-	3	-	-	3	
Montmorency	32	20	1	1	-	6	*	-	4	
Newaygo	38	27	-	-	-	1	-	-	10	
Oceana	5	3	-	-	-	1	-	-	1	
Ogemaw	19	11	-	*	-	8	-	-	*	
Osceola	17	14	-	-	-	-	-	-	3	
Oscoda	54	26	*	1	-	26	-	-	1	
Otsego	*	*	-	*	-	-	-	-	-	
Presque Isle	19	13	1	2	-	1	*	-	2	
Roscommon	44	28	*	-	-	13	-	-	3	
Wexford	29	22	-	-	-	4	-	-	3	
Total	644	388	3	8	-	138	1	-	103	3

MICHIGAN (cont'd)

District & county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[2]
	(Thousand standard cords, roughwood basis)									
S. ½ LOW.PEN.										
Allegan	2	1	-	-	-	*	-	-	1	
Barry	*	-	-	-	-	-	-	-	*	
Berrien	*	*	-	-	-	-	-	-	*	
Eaton	*	*	-	-	-	-	-	-	*	
Gratiot	*	*	-	-	-	-	-	-	*	
Hillsdale	*	*	-	-	-	-	-	-	*	
Ionia	*	*	-	-	-	-	-	-	*	
Kalamazoo	1	*	-	-	-	*	-	-	1	
Kent	*	*	-	-	-	*	-	-	*	
Lapeer	*	*	-	-	-	-	-	-	-	
Montcalm	7	5	-	-	-	*	-	-	2	
Muskegon	2	1	-	-	-	*	-	-	1	
Ottawa	1	*	-	-	-	1	-	-	*	
St. Joseph	*	*	-	-	-	-	-	-	-	
Sanilac	1	1	-	-	-	-	-	-	-	
Tuscola	3	2	-	-	-	1	-	-	*	
Van Buren	*	*	-	-	-	-	-	-	*	
Total	55	10	-	-	-	2	-	-	5	38
State total	1,570	776	88	13	99	250	74	1	194	75

[1] Includes only those counties that supplied pulpwood in 1966.

[2] County figures are not available.

* Less than 500 cords.

MINNESOTA

District and county[1]	All species	Aspen	Balsam	Birch	Pine	Spruce	Tamarack	Misc. hdwds.	Residue & chips[2]
	(Thousand standard cords, roughwood basis)								
NORTHEASTERN:									
Carlton	28	24	1	-	2	1	*	*	
Cook	38	1	1	-	1	35	-	-	
Lake	73	16	2	-	46	9	-	-	
Pine	4	2	*	-	1	*	-	1	
St. Louis	303	162	16	-	88	33	1	3	
Total	449	205	20	-	138	78	1	4	3
CENTRAL PINE:									
Aitkin	54	43	2	-	2	3	1	3	
Becker	10	10	*	-	*	-	*	-	
Beltrami	107	66	11	*	20	5	1	4	
Cass	48	27	3	1	14	1	1	1	
Clearwater	49	33	1	*	9	2	*	4	
Crow Wing	15	6	*	-	9	*	-	-	
Hubbard	32	17	1	-	13	*	1	-	
Itasca	117	64	17	-	13	20	2	1	
Wadena	11	6	-	-	5	-	-	-	
Total	449	272	35	1	85	31	6	13	6
RAINY RIVER:									
Koochiching	206	118	24	-	8	43	*	13	
Lake of the Woods	31	5	1	-	7	18	-	*	
Total	237	123	25	-	15	61	*	13	-
HARDWOOD:									
Mille Lacs	*	*	-	-	*	*	-	*	
Morrison	3	3	-	-	*	-	-	-	
Scott	*	-	-	-	*	-	-	-	
Todd	1	-	-	-	1	-	-	-	
Total	10	3	-	-	1	*	-	*	6
PRAIRIE:									
Mahnomen	7	5	-	-	1	*	*	1	
Polk	2	1	-	-	1	*	*	-	
Roseau	20	3	-	-	15	2	*	-	
Total	29	9	-	-	17	2	*	1	-
State total	1,174	612	80	1	256	172	7	31	15

[1] Includes only those counties that supplied pulpwood in 1966.

[2] County figures are not available.

* Less than 500 cords.

PART II. IN THE CENTRAL STATES

HIGHLIGHTS

Pulpwood production in the Central States in 66 was 276,000 cords, one-fifth more than in 65. Nearly all of this wood was retained in the gion. All Central States except Missouri shared the gain.

Fourteen Central States pulpmills processed 0,700 cords of pulpwood in 1966, an increase of percent from 1965. Again, a strong national onomy, coupled with the expanding U.S. popu- tion (using more paper products per capita than 1965) was the primary reason for the increased nsumption of pulpwood.

By 1970, the region could become a large ex- rter of pulpwood to new mills proposed for entucky.

oundwood Harvest Rises 16 Percent

After declining 42,000 cords in 1965, the pulp- ood cut of roundwood increased 34,000 cords in 66 to 237,600 cords. Most of the increased har- est was in Illinois and Indiana as shown in the year summary below.

		In thousand cords			
State	*1962*	*1963*	*1964*	*1965*	*1966*
Illinois	120	102	105	77	97
Indiana	87	79	85	82	94
Iowa	28	20	33	25	27
Missouri	21	21	23	20	19
Total	256	222	246	204	237

Illinois regained the roundwood-producer lead- ship from Indiana when the cut rebounded 9,700 cords from 1965. Even so, Indiana had a cord harvest in 1966. Slightly more than two- irds of the Illinois cut was used in the State. inety-seven percent of the Central States round- ood harvest was used by regional mills.

Soft hardwoods[6] accounted for 55 percent of e regional pulpwood cut, hard hardwoods 40 ercent, and softwoods 5 percent. Central States ggers felled 28,000 more cords of hard hard- oods in 1966 than the previous year, but 1,600 rds less of soft hardwoods. Softwood cutting as up 6,900 cords.

Illinois and Indiana cut three-fourths of the ft-hardwood pulpwood in 1966. Compared to 965, output changes in the four States were inor. However, soft-hardwood exports from the region dropped 4,000 cords from 1965 to a nominal 400 cords. As a result, regional consumption of local soft hardwoods was up 2,400 cords.

Hard hardwood[7] pulpwood production in 1966 spurted 42 percent ahead of 1965. Indiana loggers cut half of the regional total, but the largest gain over 1965 occurred in Illinois, where production nearly doubled. Missouri produced only 800 cords. From a year earlier, hard-hardwood pulpwood exports increased 6,400 cords in 1966, but use of local wood was up 21,000 cords.

As for softwoods, the 1966 regional pulpwood harvest was only 11,100 cords, but compared favorably with only 4,200 cords harvested the year before. Less than 200 cords left the Central States compared to 2,600 cords exported in 1965. Illinois produced nearly all of the softwood volume.

No counties cut over 10,000 cords of pulpwood in 1966 (fig. 9). High-producing counties included Gibson, Sullivan, and Ripley in Indiana; Will and Pope in Illinois; and Appanoose in Iowa. Of the 124 pulpwood-producing counties, 55 were in Illinois, 38 in Indiana, 16 in Iowa, and 15 in Missouri. As in the past, most mills satisfied their pulpwood requirements within 50 miles of the mill.

Consumption 43,000 Cords Above 1965

Of the 300,700 cords of pulpwood consumed in 1966 in the Central States, 82 percent was roundwood (table 4). The volume of hard-hardwood pulpwood processed was up 22,200 cords from 1965 and softwood use increased 9,400 cords. Soft-hardwood consumption increased only 3 percent, but was more than half of all roundwood consumed.

After declining rapidly for 3 years, roundwood use in Illinois in 1966 increased to 84,700 cords, slightly above the 1964 level. Roundwood processing in the other Central States also returned to the 1964 level.

Seventy percent of the 17,700 roundwood cords imported were soft hardwoods; the remainder were hard hardwoods.

In 1966, 9 of the 14 Central States pulpmills processed 53,400 cords of residues, 7,400 more than in 1965. More than three-fourths were hardwood residues, of which one-fourth was imported. On the other hand, two-thirds of the 12,400 cords of softwood residues processed were imported, primarily from the Lake States.

---

[6] *Soft hardwoods include soft-textured hardwood ecies such as elm, basswood, soft maple, yellow- oplar, and cottonwood.*

[7] *Hard hardwoods include hard-textured hardwoods such as oak, hard maple, beech, and hickory.*

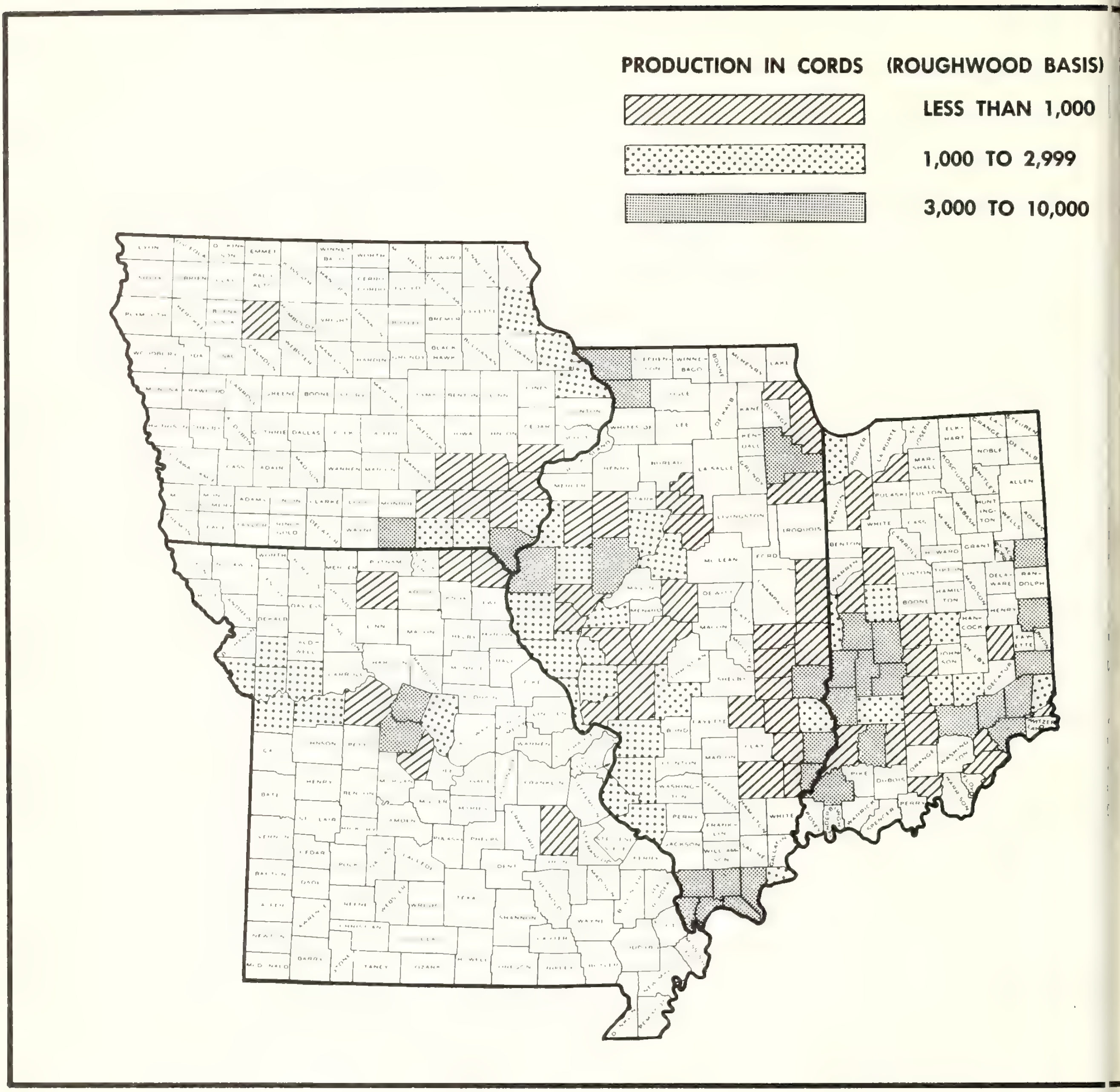

FIGURE 9. — Harvest of pulpwood bolts by counties, 1966.

TABLE 4. — *Trends in consumption of roundwood and residues as pulpwood, Central States, 1962-66*

Type of material and area	1962	1963	1964	1965	1966
Roundwood					
Illinois	106	91	82	68	84
Indiana, Iowa, Missouri	160	142	163	143	163
Total	266	233	245	211	247
Residue					
Illinois	13	17	25	22	25
Indiana, Iowa, Missouri	7	12	14	24	29
Total	20	29	39	46	54
All material	286	262	284	257	301

Seventy percent of the residue consumed was ips; the rest was wood flour, sawdust, and neer cores.

entral States May Become Large Pulpwood uppliers to Kentucky

Central States pulpmill capacity is about 1,500 ns per day; of this, Illinois contains over half table 5). About 800 tons is semi-chemical and 00 tons is groundwood and other mechanical rocess capacity.

Except for one mill proposal for Missouri, no new capacity has been announced for the region. However, three new pulpmills proposed for Kentucky would probably receive much wood from Indiana, Illinois, and Missouri. If built, these mills will have a total daily capacity of 1,100 tons by 1970; at least 800 tons will be semi-chemical. One mill would border on Indiana, another would be about 70 miles from Indiana, and the third would be adjacent to Illinois and Missouri. Thus, the southern tiers of counties in the Central States may soon ship large volumes of pulpwood to Kentucky, and economic prospects for loggers and woods workers in these counties would be brighter.

TABLE 5 — *Active woodpulp mills in the Central States by location, type of pulp produced, and capacity, 1966*

Company	Location	Mill capacity in tons per 24 hours[1/]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Illinois:						
Allied Chemical Corp	Peoria	190	--	--	190	--
Alton Box Board Co	Alton	300	--	--	--	300
Bird & Son, Inc	Chicago	40	--	--	40	--
Certain-Teed Products Corp	East St. Louis	100	--	--	100	--
Flintkote Co., The	Mt. Carmel	40	--	--	40	--
Johns-Manville Products Corp	Waukegan	65	--	--	65	--
Ruberoid Co., The	Joliet	95	--	--	95	--
Total	7 plants	830	--	--	530	300
Indiana:						
Container Corp. of America	Carthage	120	--	--	--	120
Weston Paper & Manufacturing Co	Terre Haute	150	--	--	--	150
Total	2 plants	270	--	--	--	270
Iowa:						
Allied Chemical Corp	Dubuque	90	--	--	--	90
Crandon Paper Mills, Inc	Fort Madison	135	--	--	--	135
United States Gypsum Co	Fort Dodge	2/	--	--	--	--
Total	3 plants	225	--	--	--	225
Missouri:						
Huebert Fiberboard, Inc	Booneville	60	--	--	60	--
Ruberoid Co., The	Kansas City	100	--	--	100	--
Total	2 plants	160	--	--	160	--
All States	14 plants	1,485	--	--	690	795

1/ Lockwoods Directory of the Paper and Allied Industries-1967, and 1967 Directory of the Forest Products Industry.
2/ Capacity not available.

CENTRAL STATES PULPWOOD PRODUCTION AND RECEIPTS, BY STATE, 1966

Species group and destination	Production by states[1]					Imports			Total Receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake States	Other U.S.	Total Imports	
					In standard cords unpeeled[2]				
oftwoods									
Illinois	10,442	525	-	32	10,999	-	-	-	10,999
Ind., Iowa, Mo.[3]	-	-	-	-	-	-	-	-	-
Exported[4]	-	137	-	-	137	-	-	-	-
Total	10,442	662	-	32	11,136	-	-	-	10,999
oft hardwoods									
Illinois	36,988	5,397	-	-	42,385	577	6,352	6,929	49,314
Ind., Iowa, Mo.	16,725	39,605	13,959	18,367	88,656	3,996	1,461	5,457	94,113
Exported[4]	-	363	-	-	363	-	-	-	-
Total	53,713	45,365	13,959	18,367	131,404	4,573	7,813	12,386	143,427
ard hardwoods									
Illinois	19,218	4,844	-	-	24,062	-	280	280	24,342
Ind., Iowa, Mo.	13,687	35,806	13,190	852	63,535	3,600	1,416	5,016	68,551
Exported[4]	-	7,414	-	-	7,414	-	-	-	-
Total	32,905	48,064	13,190	852	95,011	3,600	1,696	5,296	92,893
otal roundwood									
Illinois	66,648	10,766	-	32	77,446	577	6,632	7,209	84,655
Ind., Iowa, Mo.	30,412	75,411	27,149	19,219	152,191	7,596	2,877	10,473	162,664
Exported[4]	-	7,914	-	-	7,914	-	-	-	-
Total	97,060	94,091	27,149	19,251	237,551	8,173	9,509	17,682	247,319
esidues, softwood									
Illinois	3,904	-	-	-	3,904	6,762	1,762	8,524	12,428
Ind., Iowa, Mo.	-	-	-	-	-	-	-	-	-
Total	3,904	-	-	-	3,904	6,762	1,762	8,524	12,428
esidues, hardwood									
Illinois	10,954	-	-	-	10,954	1,418	-	1,418	12,372
Ind., Iowa, Mo.	9,006	1,159	9,175	-	19,340	4,579	4,696	9,275	28,615
Exported[4]	494	1,190	-	2,580	4,264	-	-	-	-
Total	20,454	2,349	9,175	2,580	34,558	5,997	4,696	10,693	40,987
ll wood material									
Illinois	81,506	10,766	-	32	92,304	8,757	8,394	17,151	109,455
Ind., Iowa, Mo.	39,418	76,570	36,324	19,219	171,531	12,175	7,573	19,748	191,279
Exported[4]	494	9,104	-	2,580	12,178	-	-	-	-
Total	121,418	96,440	36,324	21,831	276,013	20,932	15,967	36,899	300,734

1/ Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

2/ Factors used in converting to standard green cords (128 cu.ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard-hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

3/ Combined to prevent disclosure of individual mill receipts.

4/ Pulpwood shipped to mills outside the region.

Reports on Pulpwood Production Published by the North Central Forest Experiment Station

Reports of pulpwood production in the Lake States have been published by the Station since 1946. One group of short Notes gives annual data by State and species. Another group of longer reports begun in 1959 gives more detailed information by County; in 1965, we began including data for four Central States in this report.

The longer reports are:

Pulpwood Production in Lake States Counties, by Arthur G. Horn.

1959 data:	Station Paper 85, 13 p.
1960 data:	Station Paper 94, 28 p.
1961 data:	Station Paper 106, 18 p.
1962 data:	Research Paper LS-5, 16 p.
1963 data:	Resource Bulletin LS-1, 17 p.
1964 data:	Resource Bulletin LS-2, 19 p.

Pulpwood Production and Consumption in the North Central Region by County, 1965; 24 p., by James E. Blyth, Resource Bulletin NC-2.

The serial numbers of the brief Notes for the past 10 years are:

1957:	Tech. Note 529	1962:	Research Note LS-23
1958:	Tech. Note 558	1963:	Research Note LS-48
1959:	Tech. Note 588	1964:	Research Note LS-65
1960:	Tech. Note 606	1965:	Research Note NC-3
1961:	Tech. Note 624	1966:	Research Note NC-31

THE FOREST SERVICE CREED

The Forest Service of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.

U. S. D. A. FOREST SERVICE
RESOURCE BULLETIN NC-4
1968

KANSAS WOODLANDS

JAN 20
TECH. & AGR. DIV.

CLARENCE D. CHASE
JOHN K. STRICKLER

NORTH CENTRAL FOREST EXPERIMENT STATION
D. B. King, Director
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREWORD

This report presents forest resource information for Kansas compiled from a forest survey made in 1965. It provides new statistics on forest area, timber volume, growth and cut, and forest industry.

A previous forest survey of Kansas was made in 1936 by Kansas State College in cooperation with the U.S.D.A. Forest Service. The findings were published in a report entitled *Woodlands of Kansas,* which emphasized the management of farm woodlots. The new survey consisted of a forest inventory conducted between July 1964 and June 1965, and a canvass of forest products milling activities in 1964. Both the 1936 and 1965 surveys were part of the nationwide forest survey authorized by the McSweeney-McNary Forest Research Act of 1928. The Kansas Legislature appropriated $39,000 to supplement Federal funds for the 1965 survey, making possible data summary on a county basis in heavily forested parts of the State.

The survey was designed and carried out by the North Central (formerly Lake States) Forest Experiment Station, St. Paul, Minnesota, with the assistance of Kansas State University. The Kansas Office of the Agricultural Stabilization and Conservation Service provided the necessary aerial photos. Photographs for the text were supplied by the Extension Forester, Kansas State University.

Paul S. DeBald,[1] North Central Forest Experiment Station, directed the survey with assistance from John K. Strickler, Associate State Forester of Kansas, and Arnold J. Ostrom, Field Supervisor from North Central. The timber industry of Kansas was surveyed by Leonard K. Gould, Kansas State University. Burton L. Essex, Arthur G. Horn, (now retired) and Mr. Ostrom, all of the North Central Station, were responsible for computing and compiling the data.

Landowners who would like guidance in obtaining trees, improving their stands, or harvesting timber are advised to contact the State Extension Forester, Kansas State University, Manhattan, Kansas 66502, or their County Extension Office.

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[1] *Now with the Northeastern Forest Experiment Station.*

KANSAS WOODLANDS

Clarence D. Chase
and
John K. Strickler

NOTE: At the time this report was written Mr. Chase (now retired) was Principal Resource Analyst, North Central Forest Experiment Station, St. Paul, Minnesota. The Station is maintained in cooperation with the University of Minnesota. Mr. Strickler is Associate State and Extension Forester, Kansas State University, Manhattan, Kansas.

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IN BRIEF

The natural forests of Kansas occupy about 1.3 illion acres, or 2.6 percent of the State's land area. pproximately 1,192,000 of these acres are classified commercial forest land. An additional 215,000 res of nonforest wooded-strip land meet the na- onal standard for commercial forest in every respect cept that these strips are less than 120 feet wide. ost of the woodland is in the eastern third of the ate where rainfall is most abundant. In western ansas, forests become more and more closely con- ned to the river valleys as rainfall diminishes.

The forest acreage has increased in the last 30 ars, mostly as a result of natural restocking of idle rmland. Windbreak and shelterbelt plantings have dded substantially to the total wood volume, but ost of these are not classified as commercial forest. orest land area is expected to decrease in years to ome, largely because of urban expansion and chang- g land use.

The Kansas forests, primarily hardwood, are com- osed of two major forest-type groups: oak-hickory, ound mostly on the eastern uplands, and elm-ash- ottonwood, abundant in the eastern lowlands and ollowing the stream bottoms into the western part the State. Cottonwood and elm are the most bundant species, comprising over half the saw- mber volume. Black walnut, however, is the most aluable species; in 1963 only Indiana showed a rger cut of walnut logs.

The woodlands have been depleted over the years a result of poor logging practices, grazing, and urning. Many stands are understocked with vigor- us thrifty growing-stock trees; 7 out of 10 acres eed timber harvest or silvicultural treatment to in- ease the number of desirable trees and reduce competing vegetation. The forest improvements in future years will depend on the attitudes of the small-private-woodland owners, mostly farmers, who control the timber resource.

Insufficient logging in the last 30 years has resulted in a surplus of large trees. In fact, over half the total wood volume in Kansas is in trees larger than 15 inches in diameter. Black walnut is the only exception because its high value has resulted in heavier cutting. Fortunately, the future of such species as hackberry, ash, and soft maple is beginning to look brighter, since the demand for high-quality logs is increasing.

Net growth of timber on commercial forest land in 1964 exceeded cut by about four times. Black walnut, bur oak, soft maple, and cottonwood made up over half the cut. Allowing for overcutting in certain species and quality classes, and changes in land use, it appears that the growing-stock cut could easily be increased 75 percent and the sawtimber cut 30 percent over the 1964 level.

The outlook for forestry in Kansas is favorable. The potential for manufacturing forest products is not yet fully developed. Primary processors in and immediately adjacent to Kansas are expanding their operations to take advantage of improved markets for the high-quality sawtimber, but there is a real need and opportunity for secondary processors to utilize the lumber being manufactured. Kansas also needs more forest products industries that can use small and low-quality material. The development of more of these industries, such as pulpmills, charcoal plants, and pallet manufacturers, would allow a more effective and complete utilization of Kansas timber resources.

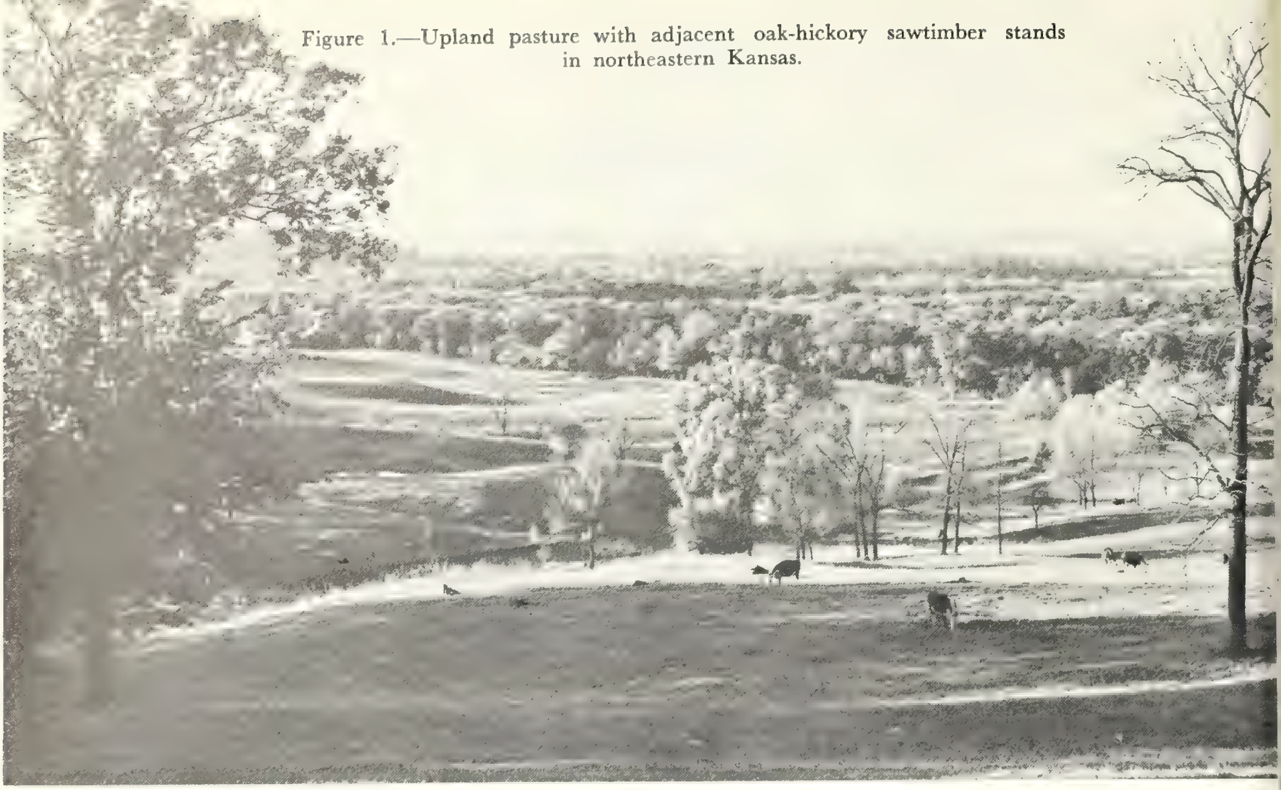


Figure 1.—Upland pasture with adjacent oak-hickory sawtimber stands in northeastern Kansas.

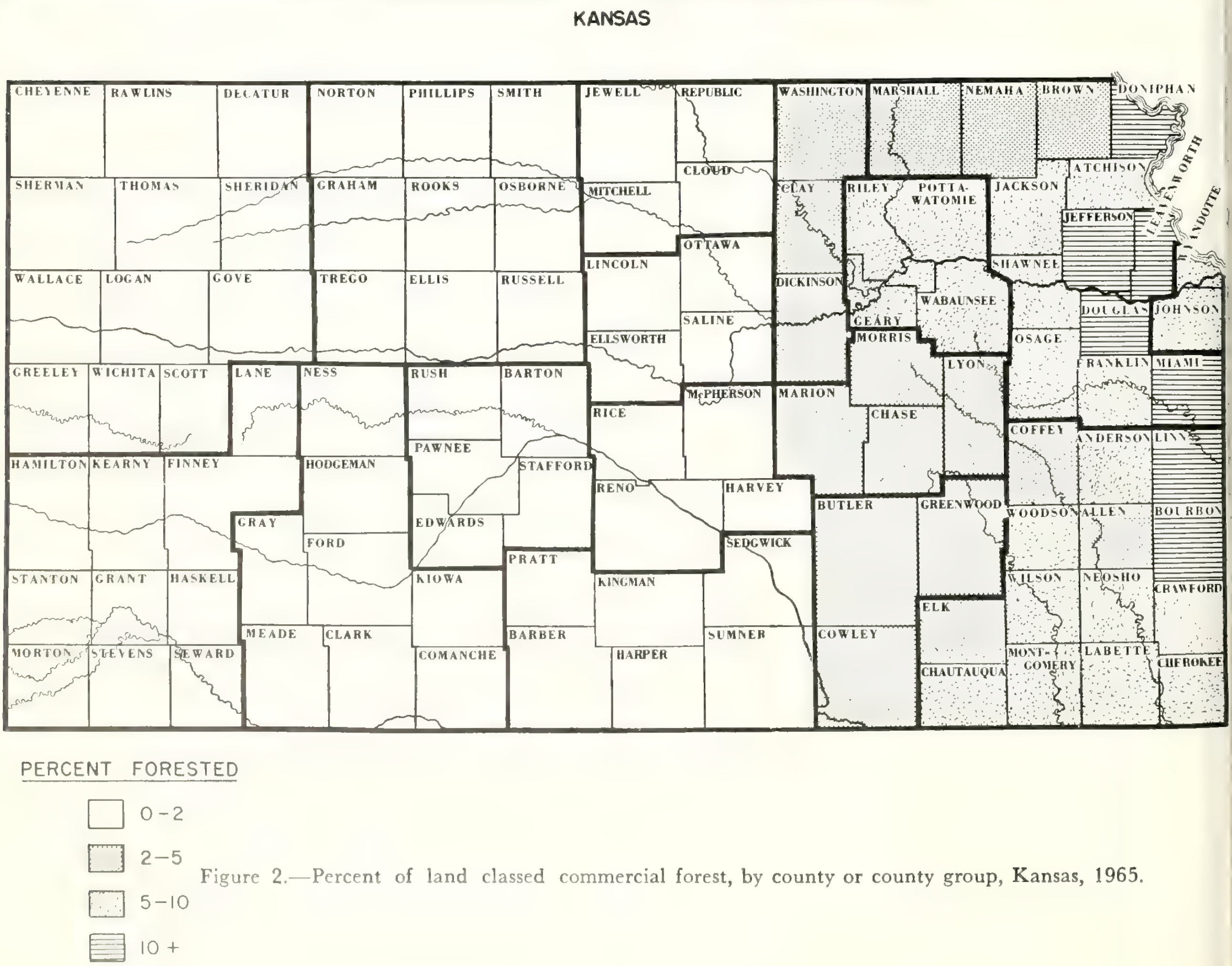


Figure 2.—Percent of land classed commercial forest, by county or county group, Kansas, 1965.

TIMBER TRENDS

FOREST AREA

est Land Pattern Changing

oday Kansas has roughly 1.2 million acres of mercial forest land, about 92,000 acres more n in 1936. The increase over the past 30 years been due largely to natural regeneration of pasture and cropland, rather than artificial restation. Although nearly 2,500 acres have been nted annually in recent years, 80 percent are in forest windbreak and shelterbelt plantings.

oncommercial forest land, or land incapable of ding a merchantable timber crop, covers 157,400 es in Kansas. Blackjack and post oak stands in southeastern part of the State account for three- rths of this unproductive land. These are found narily on the poorer upland sites characterized by llow, rocky soils.

uring the next 30 years changes in land use are ected to reduce the commercial forest area by ut 40,000 acres. Gains from reforestation will bably not be large enough to offset losses due agriculture, urban expansion, reservoirs, highways, l recreational developments.

onforest" Land Important

o be classified as "forest" by national survey ndards, land must support timber stands at least feet wide. Yet, about 215,000 acres of naturally oded land in Kansas are in narrow strips less than feet wide. Classified as "wooded strip," these as meet all the requirements for commercial est land except width. It should be noted that ndbreaks, shelterbelts, and fence rows are not in- ded in the wooded strip classification. Because essibility of the wooded strips for logging makes ir use for commercial timber production feasible, y must be considered as part of the timber re- rce. With 80 percent of the wooded-strip area the bottomland types, most sites have the capacity produce high-quality hardwood timber, but tree ality tends to be poor due to open growing con- ions. Stands are also younger on the wooded-strip d; only 14 percent of the area supports saw- nber, compared to 57 percent for commercial forest d.

n addition to wooded strips, nonforest land in- des about 370,000 acres of wooded pasture (fig. This is grazed land 10 percent or more stocked h trees, but less than 25 percent stocked with growing-stock trees. The primary use and impact on this land is grazing. It is mostly pasture or native grassland that has been invaded by such species as osage orange, blackjack oak, post oak, elm, and honeylocust. Due to a combination of grazing, adverse site conditions, noncommercial species, and poor tree quality, these wooded pastures have little or no potential for commercial timber production.

Hardwoods Dominate Timber Picture

The natural woodlands of Kansas are found principally in narrow belts along the river valleys, side drainages, and adjacent slopes; they become scarcer and more closely confined to the river banks in the western part of the State. Over 80 percent of the commercial forest land is in the eastern third of the State, where rainfall is most abundant (fig. 2). The woodlands are composed of two broad forest-type groups, which occupy about equal land areas: oak-hickory, found chiefly on the uplands in the eastern third of the State; and elm-ash-cottonwood, found mostly in the stream bottoms of the eastern half (fig. 3). The oak-hickory group includes the following distinct local types, in order of decreasing abundance: elm-ash-locust, oak-hickory, upland plains

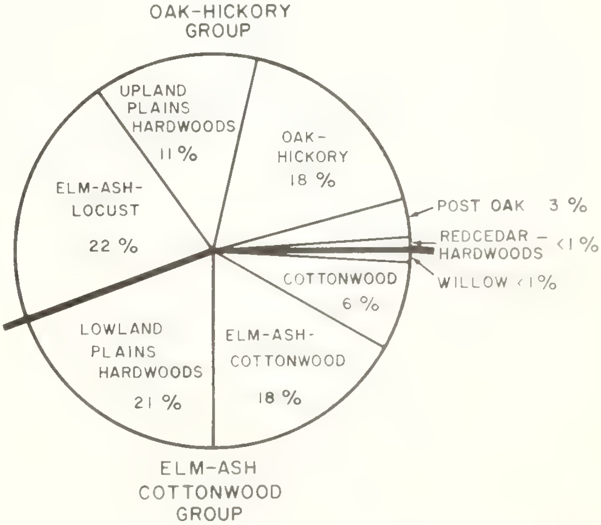


Figure 3.—Forest types by percent of commercial forest land, Kansas, 1965.

hardwoods, post oak, and redcedar-hardwoods. In the elm-ash-cottonwood group, lowland plains hardwoods are most abundant, followed by the elm-ash-cottonwood, cottonwood, and willow types (fig. 4). Bottomland, streambank, and cove sites, which are excellent for growing hardwoods, make up about two-thirds of the commercial forest land. Trees will grow over 60 feet tall in 50 years on nearly all this land.

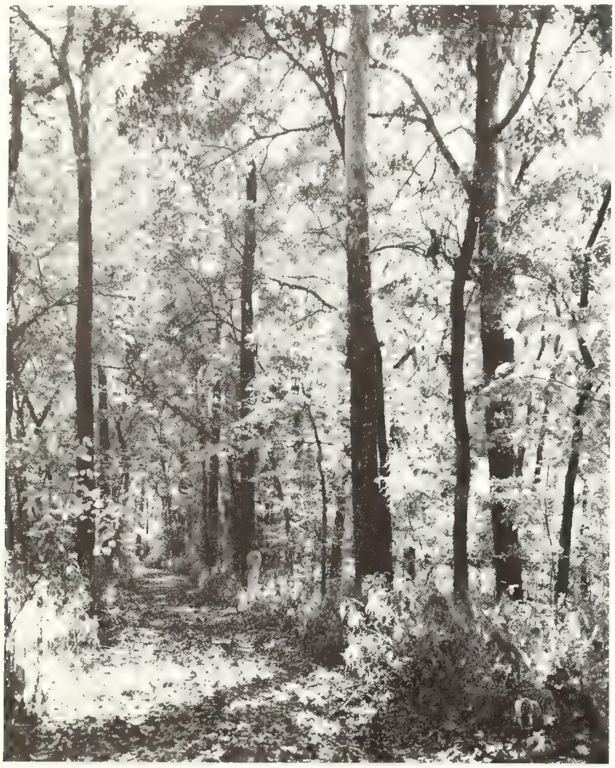


Figure 4.—An excellent bottomland sawtimber stand of elm-ash-cottonwood in eastern Kansas.

Stand Improvement Possibilities

The timber harvest in Kansas has been well below growth in the last three decades, as evidenced by the increase in sawtimber. Today sawtimber stands make up 57 percent of the commercial forest area, compared to only 46 percent in 1936 (fig. 5). Poletimber stands occupy 19 percent, sapling and seedling stands 12 percent, and nonstocked areas 12 percent. The woodlands contain a larger amount of sawtimber than would normally be carried in a long-term management program, but increased cutting in recent years, if continued, will eventually balance the stand-size distribution.

Despite the large area in sawtimber and poletimber, the woodlands of Kansas are relatively young. Half the commercial forest area supports stands less than 40 years old. Almost four-fifths of the forests are less than 60 years old, and less than a tenth exceed 80 years. Stands in the oak-hickory group e on the average younger than stands in the elm-a-cottonwood group (fig. 6).

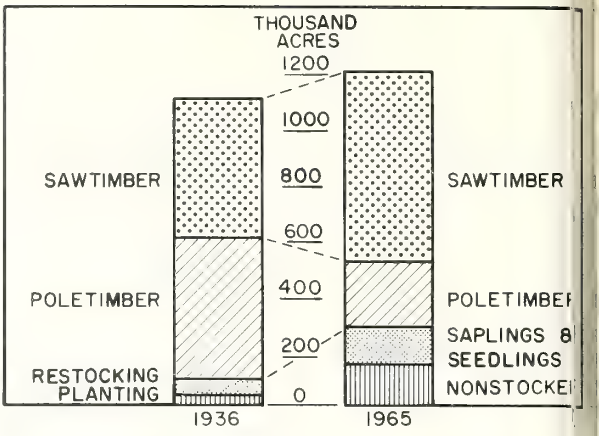


Figure 5.—Commercial forest land by stand-size cl s, Kansas, 1936 and 1965.

The number of good growing-stock trees s declined over the years as a result of "high gradin" grazing, and repeated burning. High-quality tr s harvested or lost have been too frequently repla d by less desirable trees. When all live trees are c-sidered, 92 percent of the commercial forest area s 50 percent or more stocked; but when only growi-stock trees are considered, less than one-fourth is 0 percent or more stocked. The main deficiency n Kansas woodlands at the present, then, is not sim y quantity of trees, but quantity of *good* trees. Wh e only 4 percent of the commercial forest land requi s complete reforestation, 1 acre in every 3 wo d benefit from partial or spot underplanting to fill n openings and improve species composition. About 0 percent of the forest land would benefit from sta d improvement treatments (half of which could e commercial operations), and 18 percent from harv t cutting.

Farmers own two-thirds of the commercial fo t land in Kansas, and there are no large blocks of p-vate or public ownership. Thus, upgrading the wo-lands will depend largely on the attitudes of sm l owners. While forestry is doubtless of secondary i-portance to most Kansas farmers, they will impr e their woodlands as opportunities to make pro s emerge. The present emphasis on quality hardwoo , such as black walnut, and the increase in mill g activities hold much promise for the future.

TIMBER VOLUME

Sawtimber Abundant

The present timber volume on commercial fo t land in Kansas approaches 825 million cubic fe.

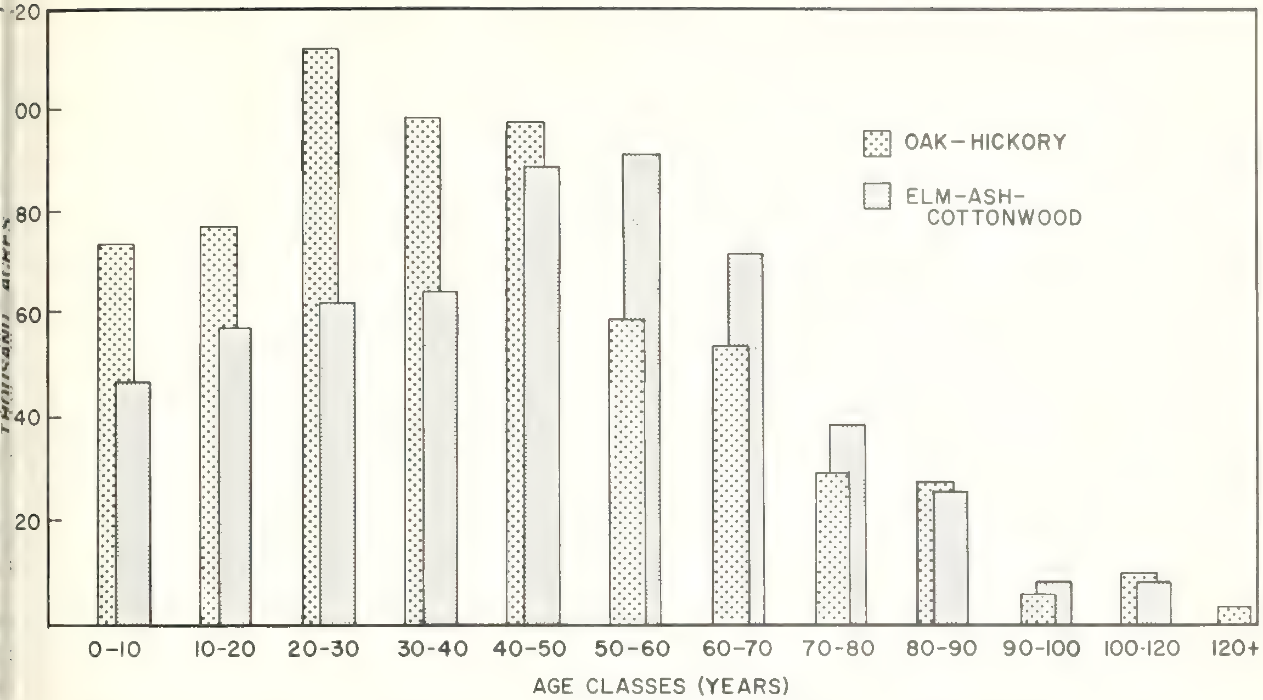


Figure 6.—Distribution of oak-hickory and elm-ash-cottonwood type groups by age classes, Kansas, 1965.

ty-nine percent is in growing stock trees, 40 per- it in rough (including short-log) and rotten trees, d 1 percent in salvageable dead trees. The growing- ck volume is about 490 million cubic feet.

The sawtimber volume on commercial forest land pproximately 1.8 billion board feet by the Inter- ional ¼-inch rule; short-log trees contain an litional 260 million board feet. Short-log trees, ich are commonly merchantable in the central tes, contain one or more 8-to-11-foot logs, but do have the 12-foot log required by national survey ndards for a growing-stock tree.

The volume breakdown by species shows that tonwood and elm comprise almost half the total vtimber (fig. 7). Cottonwood is relatively more ındant in western Kansas, but gives way to elm the eastern third of the State, where 80 percent of total sawtimber volume is found.

Poletimber stands have a slightly different species nposition than sawtimber stands. For instance, tonwood makes up 24 percent of the sawtimber, t only 11 percent of the poletimber volume (fig. 7 It appears that cottonwood, elm, and select white ks will be partially replaced by such species as ck walnut, hackberry, and ash in the future.

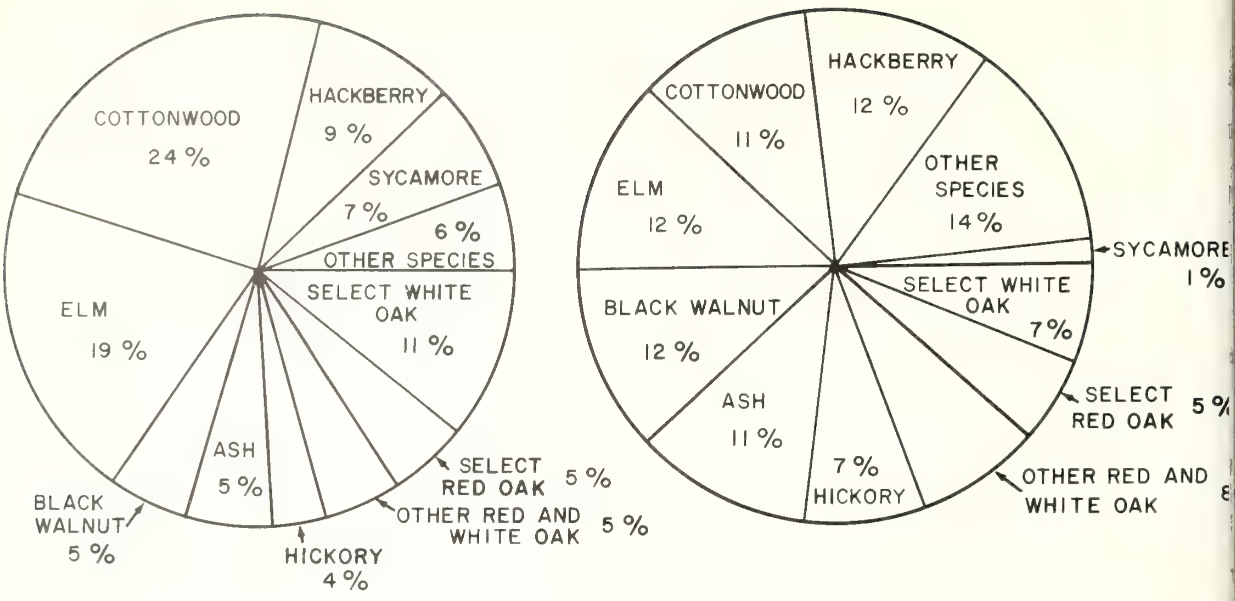
In addition to the timber on commercial forest d, Kansas has nearly 184 million cubic feet on oded strips. This includes 98 million cubic feet sound timber, roughly one-fifth the amount found commercial forest land. The total sawtimber volume in growing stock and short-log trees on wooded strips is 443 million board feet.

Sawtimber Quality High

Insufficient markets and light cutting (until recently) have caused timber to accumulate in the larger diameter classes (fig. 8). Over half the sawtimber volume is in trees 19 inches or larger in diameter; in fact, three-fourths of the cottonwood and sycamore, and about two-thirds of the elm volume is in these large trees. Since log grade is directly related to tree size, Kansas sawtimber is relatively high in quality. Grade 1 logs make up a fourth of the sawtimber volume, and grades 1 and 2 combined make up nearly half. Sycamore, black walnut, hackberry, and cottonwood are exceptionally high in quality (fig. 9).

Black Walnut A Key Species

The natural range of black walnut extends over most of the eastern half of Kansas. The species grows best on rich, well drained soils, and is most abundant in the upland plains hardwoods type. The trees are usually scattered in hardwood stands or in narrow strips along streams or fence rows (fig. 10). This species seldom grows in pure stands, although plantations have been found feasible (fig. 11). If current research results in improved management



SAWTIMBER

POLETIMBER

Figure 7.—Percent of species volumes in sawtimber-and-poletimber-size trees, Kansas, 1965.

techniques and shorter rotations, there will undoubtedly be a sharp increase in walnut planting.

The total volume of black walnut in Kansas amounts to over 60 million cubic feet; about 51 million cubic feet are found on commercial forest land, 5 million on wooded strips, and 4 million on other nonforest land. Sawtimber volume approaches 120 million board feet, 62 percent of which is in grad and 2 logs.

The tree size distribution reflects much hea cutting of black walnut than other Kansas spec Poletimber trees make up 40 percent of the wal volume on commercial forest land, compared only 25 percent for all species combined. On

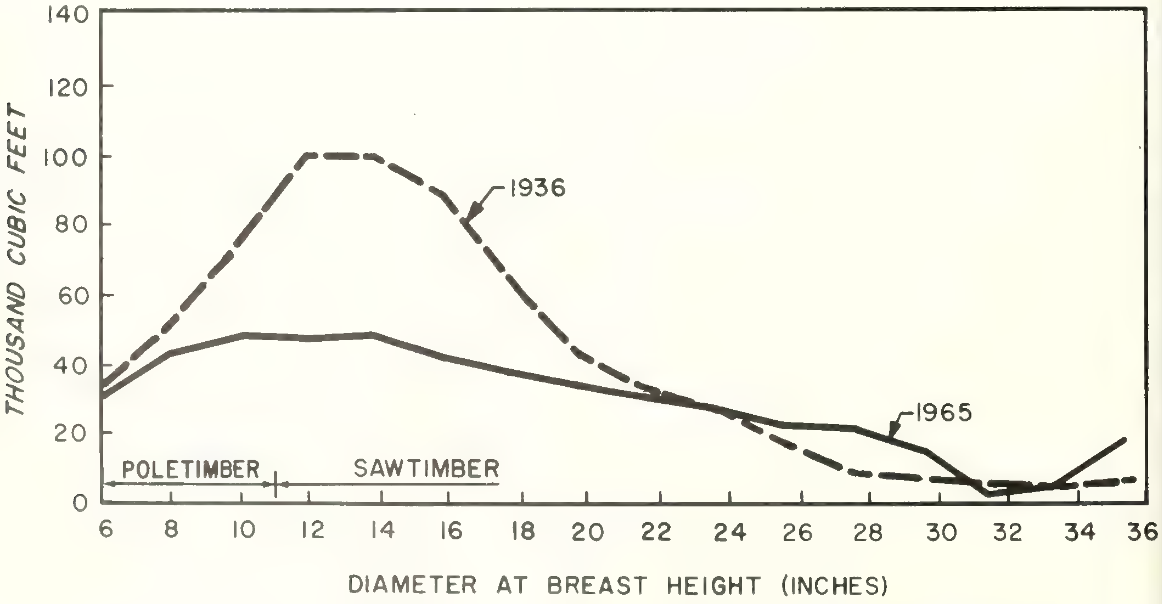


Figure 8.—Distribution of growing-stock volumes by tree diameter class, Kansas, 1936 and 1965.

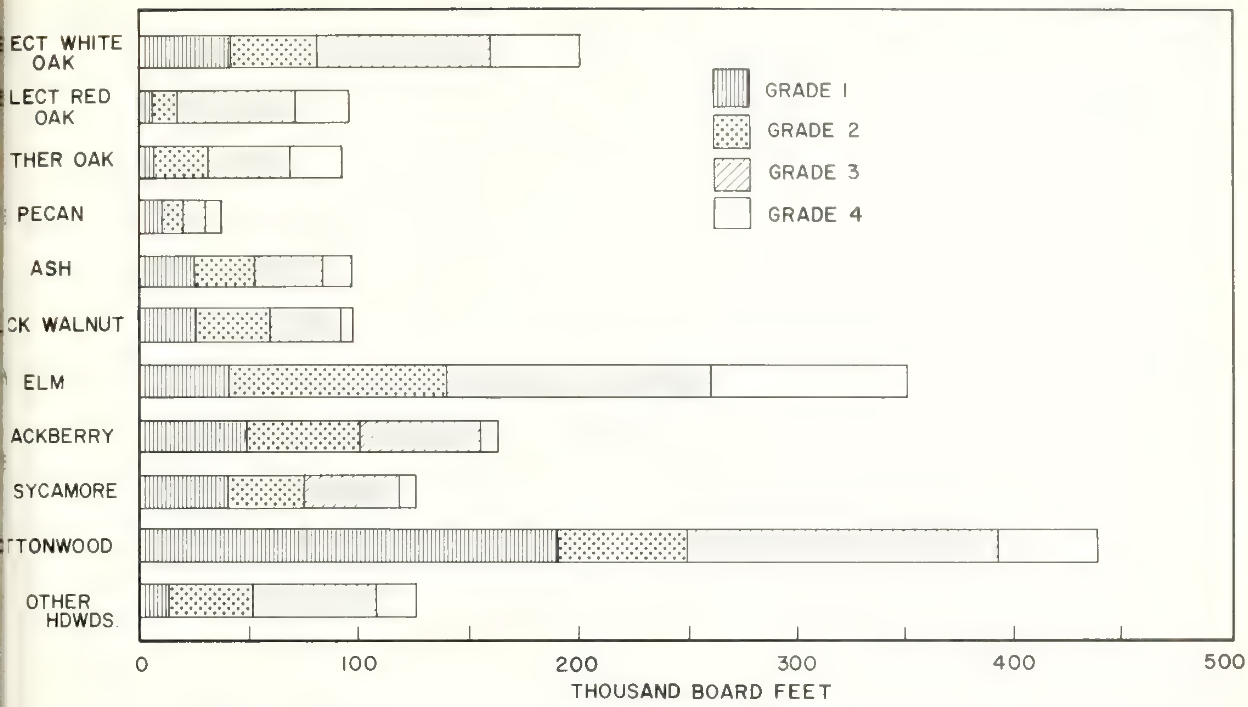


Figure 9.—Sawtimber volume by species groups and log grades, Kansas, 1965.

r hand, only 15 percent of the walnut sawtimber
n trees larger than 19 inches in diameter com-
ed to 54 percent for all species.

lack walnut, then, provides an excellent oppor-
ity for forest management in Kansas. The major-
of the walnut growing stock is in young, vigorous
s that respond best to good management practices.
h-quality timber can be grown on relatively short
tions, thus offering the timber grower a good
rn on woodland property.

TIMBER GROWTH AND CUT

iber Growth Good

he net growth of growing stock on commercial
st land in 1964 was 24.5 million cubic feet, or
ut 20.5 cubic feet per acre. However, net growth
1964 may be somewhat higher than normal for
nsas because of adequate rainfall and low mortal-
in that year. The 1964 mortality estimate was
ed on the average for the years 1962-64, which
e all years of low mortality. Adjusting the net
wth for average mortality over a longer period of
e gives a more reliable growth estimate — called
t *trend* growth" — for making long-range plans
projections. The net trend growth of growing
k in 1964 was 14 million cubic feet, somewhat
than the actual.

Sawtimber net annual growth was in excess of 85 million board feet, or about 71 board feet per acre; again, adjustment for long-term mortality gives a trend annual growth figure of slightly more than half this amount. Cottonwood made up a fourth of

Figure 10.—Isolated high value veneer quality black walnut trees along fence rows or in pastures are merchantable in eastern Kansas.

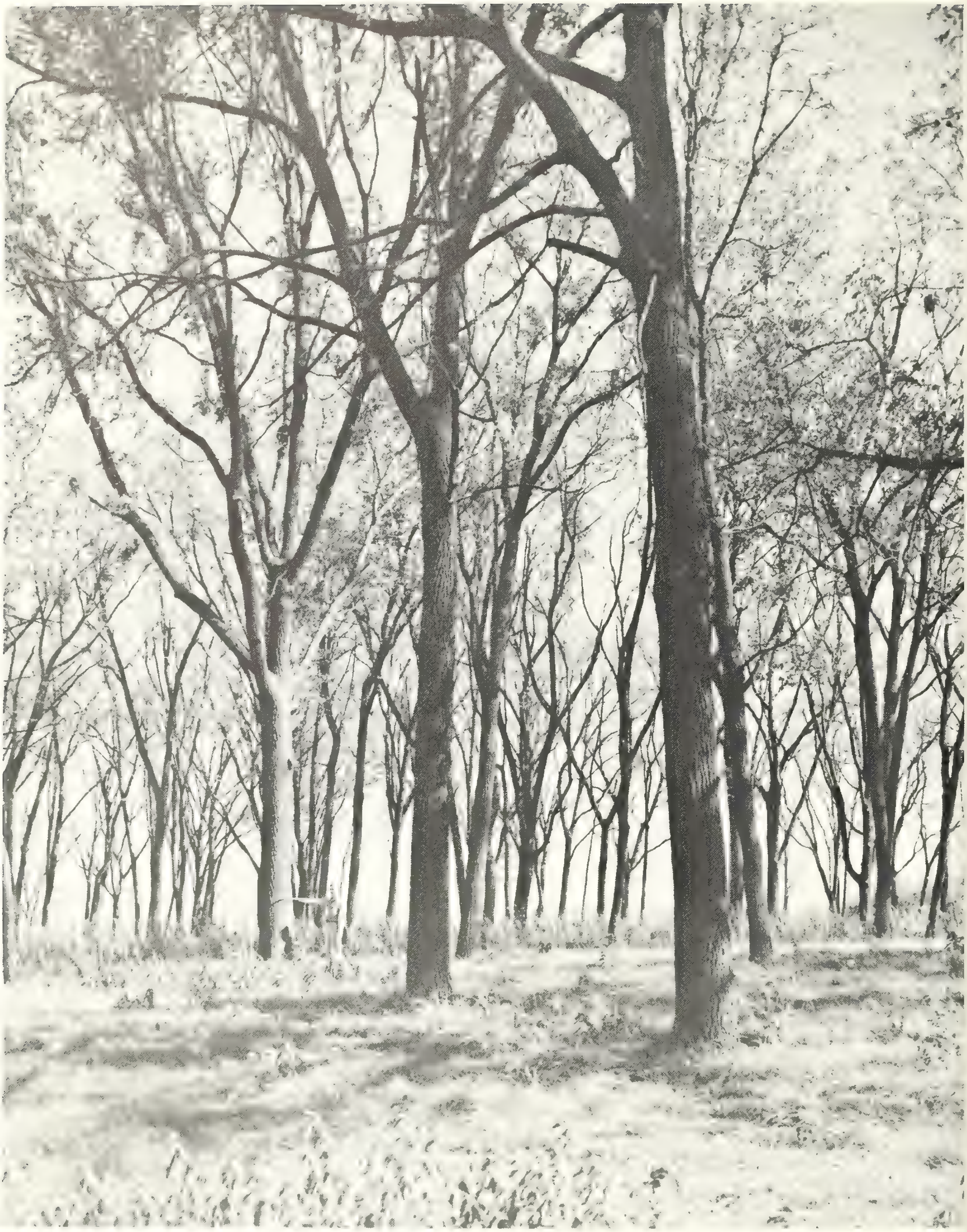


Figure 11.—High quality black walnut sawtimber in a 50-year old plantation.

t total sawtimber growth in 1964; hackberry and ck walnut added nearly another fourth. Cottonod provides the most sawtimber growth in northern Kansas, but gives way to hackberry in the theastern portion of the State; in western Kansas, onwood far exceeds all other species, providing r 60 percent of the sawtimber growth.

he average sawtimber growth rate in 1964 was percent, but ranged from as low as 1.6 percent elm to as high as 9.6 percent for black walnut. hough walnut is a fast-growing tree, this abnor- ly high rate, due to ingrowth and an abundance mall, fast-growing sawtimber trees, will probably er off in the future.

s indicated earlier, tree mortality varies widely he Great Plains. It was high in the 1930's and -1950's in Kansas, but has been low in recent rs. The average annual mortality for the years 2-64 was only 7 million board feet, or 0.4 percent he sawtimber volume. Elm was the hardest hit ies in 1964, losing 5.4 million board feet. Disease, major cause of mortality, was responsible for 94 cent of the sawtimber mortality and 84 percent he growing stock mortality. Dutch elm and other diseases were the primary causes.

iber Cut Low

he cut of growing stock on commercial forest l in 1964 was approximately 5.8 million cubic — only one-fourth the net growth for that year. ck walnut made up 20 percent of the total cut, owed by bur oak and soft maple with 13 and 11 cent. Despite the fact that cottonwood has the atest growing-stock volume, it provided only 10 cent of the cut.

imber harvesting in 1964 reduced the total grow- -stock volume by about 1.2 percent; soft maple ume, however, was reduced by 7.0 percent and k walnut by 3.3 percent. More than 90 percent of the timber harvest came from the eastern third of the State.

The sawtimber cut on commercial forest land amounted to 29 million board feet, or 1.6 percent of the State's total. Black walnut accounted for one-fourth of the sawtimber cut, and cottonwood and bur oak each one-eighth. The walnut sawtimber volume was reduced by 7.6 percent, most of the cut coming from the northeastern part of the State.

Total timber removal is somewhat greater than timber cut since it includes trees that are destroyed as forest land is cleared, flooded, or converted to other uses. Removals in addition to cut in 1964 were estimated at 2.3 million cubic feet.

Growth and Removal Not in Balance

Ideally, under a long period of sound management, timber stands should be in balance with growth equal to cut. This situation does not exist in Kansas because inadequate harvesting has resulted in a surplus of large-diameter trees. Although heavy cutting may be justified for a time in order to harvest overmature trees, care should be taken to distribute the cut evenly until young growth is ready for harvest. Measures should be taken to increase the use of less desirable species and log grades, and at the same time restrict the overcutting of desirable species and high-quality material.

Comparing the 1964 growth and cut may be misleading because net growth was probably higher and cut lower than the average for recent years. Trend growth and timber removal provide a better comparison, but even these figures are not precise. However, it is evident that soft maple is being overcut, while cottonwood, ash, hackberry, select red oaks, and "other hardwoods" are building up surpluses. Trend growth-cut comparisons indicate that growing-stock removal can be increased 75 percent and sawtimber 30 percent above present levels.

TIMBER PRODUCTS AND FOREST INDUSTRIES

SAW LOGS MOST IMPORTANT

lmost 9 million cubic feet of timber products e from Kansas woodlands in 1964. Although the of fuelwood and fence posts has declined sharply e 1935, more wood is still used for fuel than for other product. Yet veneer and lumber logs must considered the most important forest products ause they have higher values and account for the gest drain on the growing stock.

Over 60 percent of the total harvest in 1964 came from growing-stock trees, while the remainder came from limbwood, dead, cull, and short-log trees, plant by-products, and trees from noncommercial or nonforest land. About 80 percent of the growing-stock trees harvested were sawtimber size.

Forty-five percent of the growing stock harvested was used for saw logs, 35 percent for fuelwood, 13 percent for veneer and cooperage logs, and 7 percent for all other products. Very little logging residue is utilized in Kansas.

NINETY-FIVE COMPANIES PROCESSING TIMBER

Ninety-five primary wood-using plants were operating in Kansas in 1964 (fig. 12). In addition to 79 sawmills, there were 10 cooperage mills, a charcoal plant, and five fence post yards or treating plants. Eighty-seven of the 95 mills are located in the eastern third of Kansas.

While the output of lumber has decreased only 20 percent since 1935, the number of sawmills has decreased from 252 to 79. In 1935 only two mills sawed more than 1 million board feet of lumber annually, compared to six today. The reduction in output has resulted almost entirely from the closing of many small sawmills.

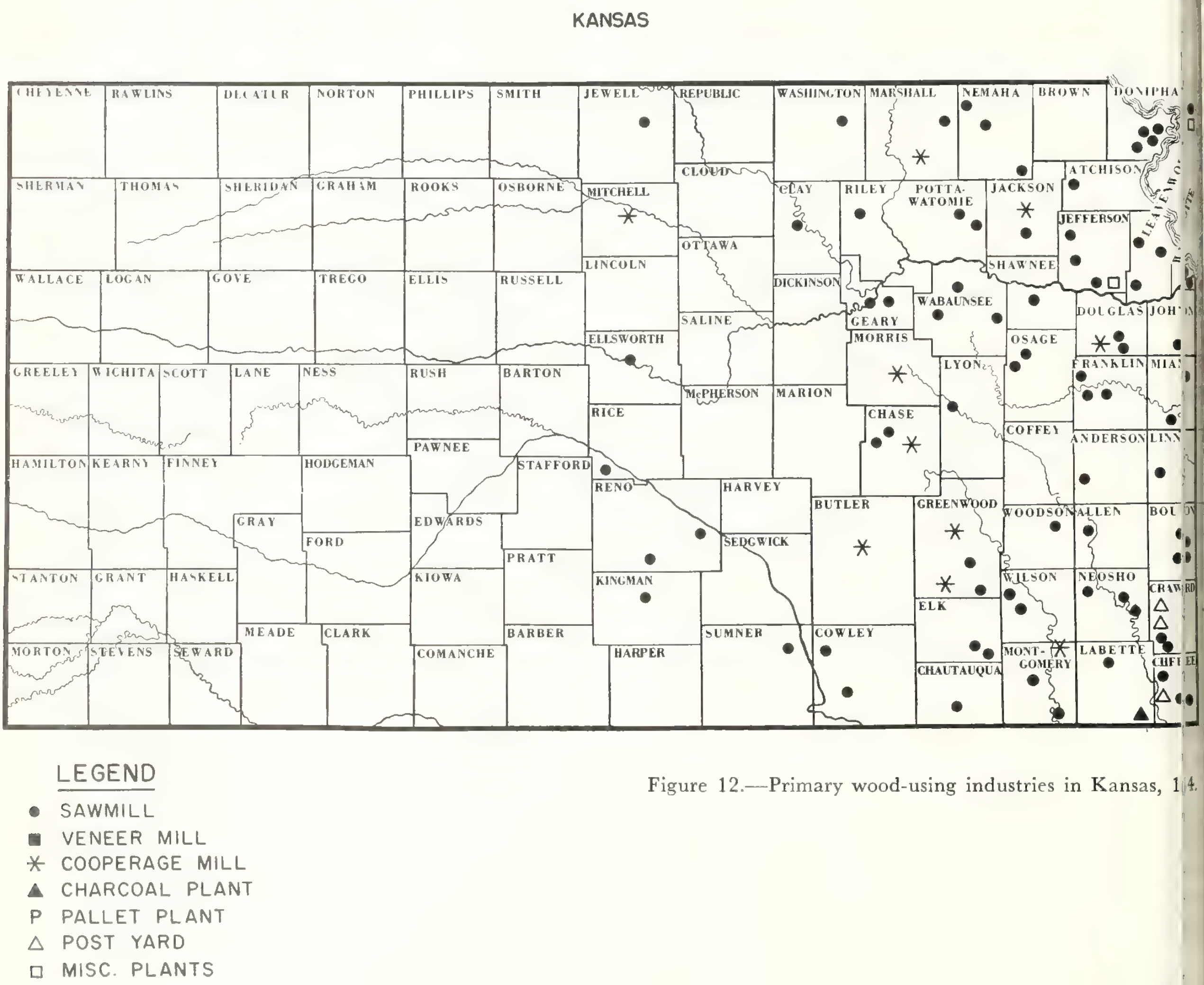


Figure 12.—Primary wood-using industries in Kansas, 1964.

LOOKING AHEAD[2]

OREST AREA EXPECTED TO DECLINE

The area of commercial forest land is expected to rease 40,000 acres in the next three decades. ban expansion, reservoirs and channel improve- nts, recreational developments, highway construc- n, and land clearing for agriculture will all con- bute to the decline. These changes will be only tially offset by forest invasion of upland pastures l other open areas. It is expected that the greatest es of forest land will be in the bottomlands, while greatest gains will be in the uplands.

Vith the exception of black walnut, few trees are ng planted today for commercial timber produc- n. Walnut planting should increase throughout tern Kansas in years to come. Increased planting such species as cottonwood, ash, and maple is icipated but not expected to reach large pro- tions.

LARGE INCREASE IN TIMBER REMOVAL FORESEEN

The gap between timber growth and removal will d to close in the next 30 years as demand for high- ality saw logs results in larger harvests. Growing- ck removal will increase from 8 million cubic feet 1965 to an estimated 13 million cubic feet in 1995, ile annual growth will rise from 14 million cubic t to 18 million cubic feet during the same period . 13). The greatest increase in cut will be in saw- ber trees, where projected removal will amount to percent of growth by 1995.

The timber harvest will be dominated by large- meter, high-quality sawtimber trees for some years come. However, as this supply begins to diminish, and quality standards will be lowered to allow ting of smaller and less valuable trees. For in- nce, walnut logs that 4 years ago would have been ded as number 2 and processed as gunstocks are w being processed as veneer logs. Also, the growing rdwood pulp market may provide an additional let for Kansas hardwoods. Many Kansas species preferred for hardwood pulp production.

OPPORTUNITIES FOR FORESTRY

Although most of the commercial forests in Kansas on good hardwood-growing land, only about 1 e out of 3 is adequately stocked with growing- ck trees. And eastern Kansas woodlands, capable of producing some of the finest hardwoods in the nation, are too often occupied by trees of poor quality and undesirable species. Land that is estimated to be capable of growing more than 100 board feet of sawtimber per acre is currently producing only 38 board feet, and is expected to yield only 52 board feet in 1995 unless management is improved.

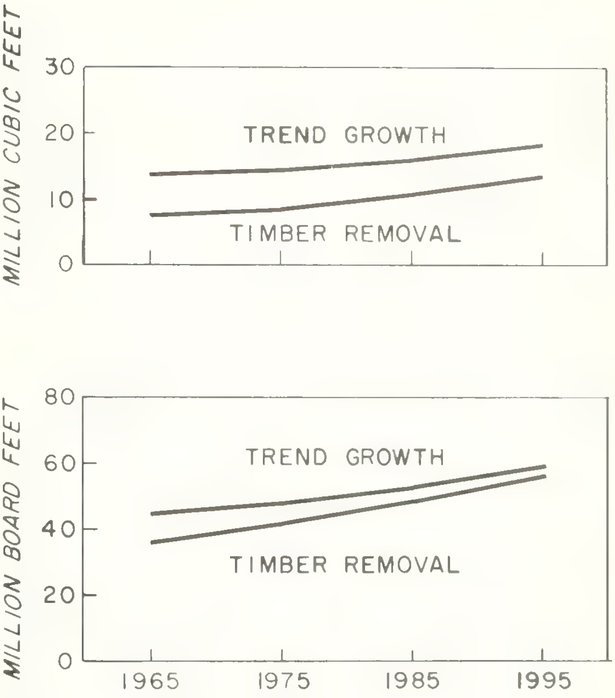


Figure 13.—Projections of growth and cut of growing stock (top) and sawtimber (bottom), Kansas.

What are some of the opportunities for rebuilding this resource? A basic need is a market for small and low-quality trees so that the costs of stand improvement may be at least partially met. A number of well-distributed fiber-using plants, charcoal plants, and post and fuel yards would help fill this need. Another distinct need is for more secondary wood manufacturing industries to complete the utilization and thus extract the greatest value from the timber resource. At present, nearly all the timber industries in Kansas are primary producers, such as sawmills.

The stability of any timber industry depends on an adequate, continuous supply of high-quality wood from the woodlands. If this is to be achieved in Kansas, small landowners must recognize timber production as a sound and profitable land use. Probably the greatest progress in rebuilding the timber resource, then, can be made by increasing the stocking of high-value trees such as black walnut, which offer the landowner a realistic opportunity for profit.

The projections presented here are based on assump- ns footnoted in table 33.

PRINCIPAL COMMERCIAL TREE SPECIES IN KANSAS[1]

SOFTWOOD SPECIES

Redcedar (eastern)	*Juniperus virginiana* L.

HARDWOOD SPECIES

Ash (green)	*Fraxinus pennsylvanica* Marsh.
Basswood (American)	*Tilia americana* L.
Birch (river)	*Betula nigra* L.
Cherry (black)	*Prunus serotina* Ehrh.
Catalpa (northern)	*Catalpa speciosa* Warder
Cottonwood (eastern)	*Populus deltoides* Bartr.
Elm includes:	
American elm	*Ulmus americana* L.
Rock elm	*Ulmus thomasii* Sarg.
Siberian elm	*Ulmus pumila* L.
Slippery elm	*Ulmus rubra* Muhl.
Hackberry	*Celtis occidentalis* L.
Hickory includes:	
Bitternut hickory	*Carya cordiformis* (Wangenh.) K. Koc
Mockernut hickory	*Carya tomentosa* Nutt.
Pecan	*Carya illinoensis* (Wangenh.) K. Koch
Pignut hickory	*Carya glabra* (Mill.) Sweet
Shagbark hickory	*Carya ovata* (Mill.) K. Koch
Shellbark hickory	*Carya laciniosa* (Michx. f.) Loud.
Honeylocust	*Gleditsia triacanthos* L.
Kentucky coffeetree	*Gymnocladus dioicus* (L.) K. Koch
Locust (black)	*Robinia pseudoacacia* L.
Maple includes:	
Hard maple—	
Black maple	*Acer nigrum* Michx. f.
Sugar maple	*Acer saccharum* Marsh.
Soft maple—	
Boxelder	*Acer negundo* L.
Red maple	*Acer rubrum* var. *rubrum* L.
Silver maple	*Acer saccharinum* L.
Mulberry includes:	
Red mulberry	*Morus rubra* L.
White mulberry	*Morus alba* L.
Oak includes:	
Select red oaks—	
Northern red oak	*Quercus rubra* L.
Shumard oak	*Quercus shumardii* Buckl.
Other red oaks—	
Black oak	*Quercus velutina* Lam.
Pin oak	*Quercus palustris* Muenchh.
Shingle oak	*Quercus imbricaria* Michx.
Select white oaks—	
Bur oak	*Quercus macrocarpa* Michx.
Chinkapin oak	*Quercus muehlenbergii* Engelm.
White oak	*Quercus alba* L.
Other white oaks—	
Post oak	*Quercus stellata* var. *stellata* Wangenh.
Persimmon (common)	*Diospyros virginiana* L.
Sycamore (American)	*Platanus occidentalis* L.
Walnut (black)	*Juglans nigra* L.
Willow (black)	*Salix nigra* Marsh.

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[1] *The common and scientific names are based on "Check List of Native and Naturalized Trees of the Unit States (Including Alaska)" by Elbert L. Little, Jr., U.S. Dep. Agr., Agr. Handb. 41, 472 p. 1953.*

APPENDIX

FOREST SURVEY METHODS

e Inventory

Kansas was divided into three Forest Survey Units, rtheastern, Southeastern, and Western (fig. 14). ta were compiled for individual counties in the re heavily wooded eastern quarter of the State. In rest of the State counties were combined into ups, which were larger in the west where woodds are less abundant. Each county group was ned for a prominent city within the area.

The inventory of forest area, timber volume, and wth was designed to provide specified statistical uracies at minimum cost. Estimates of forest area e made by classifying points systematically located aerial photos of all land and water in the State. proximately 411,000 photo points were classified determine forest and nonforest acreages. Eleven usand forest points were further examined stereopically and classified as to forest type, stand size, king, and site. Field measurements were made at 00 of these forest points to provide information arding the forest cover. Of these, 775 sample locais were established on commercial forest land.

t each of these 775 sample locations, 10 variable ius plots were established in accordance with tional Forest Survey instructions. All plot trees e measured and each location was classified as to est type, size, and condition class. Radial growth asurements and a tally of dead trees were made provide estimates of growth and mortality. Oned of the forest locations were designated "pernent plots" and marked for remeasurement. These uld provide improved growth and mortality inmation for the next survey.

oded Strip Sample

erial photo and field sampling procedures similar those for commercial forest were used in the oded strip study. The design and size of the oded strip field plots were adjusted to allow for narrowness of the strips. Although fewer trees re sampled per plot, the same individual tree asurements were taken on these plots as on the nmercial forest plots.

nber Cut

The 1964 timber production in Kansas was dertned by contacting all resident sawmills, all primary od-using establishments that obtained logs and bolts from Kansas in 1964, and other wood users within the State. The cut of fuelwood and fence posts was estimated using 1964 U.S. Bureau of Census data.

Timber product output figures were converted to standing timber volumes by kind of material and tree size with utilization factors adapted from the Missouri conversion factor and logging residue study.

ACCURACY OF STATISTICS

Forest resource statistics are subject to both sampling errors and human errors (mistakes in judgment, recording, calculation, and compilation). Human errors are minimized through close supervision and adequate training of employees and by rechecking all phases of the work. Sampling errors can be estimated by statistical methods. These errors are held to specified levels by survey design and sample size. A substantial financial contribution from Kansas State University helped make possible the low sampling errors of only ±2.1 percent for commercial forest land area, ±4.5 percent for total growing stock volume, and ±5.2 percent for sawtimber volume (see Guide). The sampling errors of growing stock growth and cut are ±5.5 percent and ±11.2 percent respectively. These sampling errors are lower than required to meet National survey standards.

As area, volume, growth, and cut figures are broken down by forest type, species, ownership, and diameter classes, sampling errors increase — the smaller the unit the higher the sampling error. Thus, while estimates for small areas or volumes may sometimes be needed, the reader should use them with caution.

Projections in this report are based on a number of assumptions and on trends which may not continue. We believe them to be reasonably accurate projections (at least for the next decade) of the changes that will take place in the timber resource of Kansas.

DEFINITION OF TERMS

Land and Forest Area

Gross area. — The entire area of land and water as determined by the Bureau of Census, 1960.

Land area. — The area of dry land and land tem-

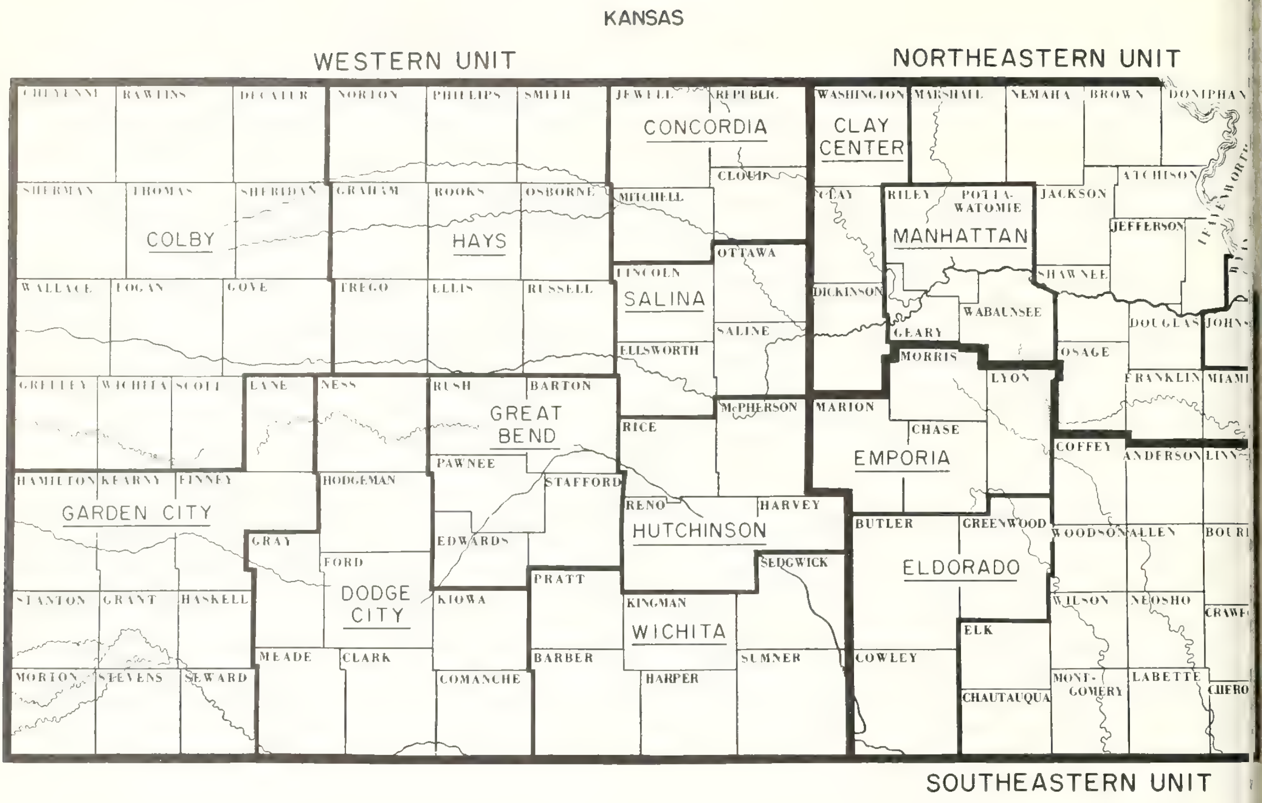

Figure 14.—Forest Survey Units and county groups, Kansas, 1965.

Guide for judging accuracy of area, volume, growth and cut, Kansas, 1965

Sampling error	Commercial forest area	Cubic foot volume	Cubic foot growth	Cubic foot timber cut
(Percent)	(Thousand acres)	(Million cu. ft.)	(Million cu. ft.)	(Million cu. ft.)
3	569	...	...	...
4	320	...	...	...
5	205	401	...	...
10	51	100	7	...
15	23	44	3	4
20	13	25	2	2
25	8	16	1	1
50	2	4	1/	1/
100	2/	1	1/	1/

1/ *Less than one million cubic feet.*
2/ *Less than one thousand acres.*

porarily or partially covered by water such as marshes, swamps, and flood plains; streams, sloughs, estuaries, and canals less than one-eighth mile wide; lakes, reservoirs, and ponds smaller than 40 acres. These figures are from the Bureau of the Census, 1960.

Forest Land.—Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonfor use. Includes afforested areas. The minimum for area classified was 1 acre. Roadside, streamside, a shelterbelt strips of timber must have a crown wid of at least 120 feet to qualify as forest land. Uni- proved roads and trails, streams, and clearings i forest areas were classed as forest if less than 120 ft in width.

Commercial forest land. — Forest land produc or capable of producing crops of industrial wo and not withdrawn from timber utilization by stat or administrative regulation.

Noncommercial forest land. — (a) Unproduct forest land incapable of yielding crops of ind- trial wood because of adverse site conditions. (Productive-reserved — productive public forest la withdrawn from commercial timber use through st- ute or administrative regulation.

Nonforest land. — Land that has never support forests, and lands formerly forested where forest r is now precluded by development for nonforest-us, such as cropland, improved pasture, residential are, and city parks. Also includes improved roads a ining rights-of-way, powerline clearings, and cer- areas of water classified by the Bureau of Census nd. Unimproved roads, streams, canals, and non- st strips in forest areas must be more than 120 wide, and clearings in forest areas must be more n 1 acre in size, to qualify as nonforest land.

wo subclasses of nonforest were recognized in survey:

Wooded pasture. — Heavily grazed, nonforest l, more than 10 percent stocked with forest trees less than 25 percent stocked with growing stock s.

Wooded strips. — Nonforest land which would been classed commercial forest except that the s were less than 120 feet wide.

nership Classes

iscellaneous Federal. — Lands owned or admin- ted by the Federal government.

tate, county, and municipal. — Lands owned by es, counties, or municipalities, or lands leased by n for more than 50 years.

armer-owned. — Lands owned by operators of ns. A farm must include 10 or more acres from ch the sale of agricultural products totals $50 nore annually or, if less than 10 acres, the yield t be at least $250 annually.

iscellaneous private. — Privately owned lands r than forest-industry or farmer-owned.

nd-size Classes

awtimber stands. — Stands at least 10 percent ked with growing stock trees, with half or more his stocking in sawtimber or poletimber trees and sawtimber stocking at least equal to poletimber king.

oletimber stands. — Stands at least 10 percent ked with growing stock trees, and with half or e of this stocking in sawtimber and/or pole- ber trees and with poletimber stocking exceeding of sawtimber.

apling-seedling stands. — Stands at least 10 per- t stocked with growing stock trees and with ing and/or seedlings comprising more than half the stocking.

onstocked land. — Commercial forest land less 10 percent stocked with growing stock trees.

Stocking Classes

Well-stocked. — Stands that are 70 percent (of area) or more stocked with growing stock trees.

Medium stocked. — Stands that are 40 to 69 percent stocked with growing stock trees.

Poorly stocked. — Stands that are from 10 to 39 percent stocked with growing stock trees.

Forest Types

Oak-hickory. — Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-50 percent, in which case the stand would be classified oak-pine. Common associates include elm, maple, and black walnut. These forests may be subtyped *redcedar-hardwood, post* (or post-blackjack) *oak, oak-hickory, elm-ash-locust,* or *upland plains-hardwoods,* depending on which species is most common. Eastern redcedar must comprise at least 25 percent of the stocking of a redcedar hardwood stand. Post or blackjack oak, singly or in combination, must comprise a majority of the stocking of a post oak stand. Upland oaks or hickory, singly or in combination, must comprise a plurality of the stocking of "local" oak-hickory stands. Upland growing elm, ash, or honeylocust, singly or in combination, must comprise a majority of the elm-ash-locust subtype. Black walnut, hackberry, or bur oak, singly or in combination, growing on upland sites must comprise a plurality of the stocking of upland plains hardwood stands.

Elm-ash-cottonwood. — Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, and maple. These forests may be subtyped *cottonwood, willow, lowland plains hardwoods,* or *elm-ash-cottonwood,* depending on which species is most common. Cottonwood must comprise the majority of the stocking of the cottonwood subtype. Willow must comprise the majority of the stocking of the willow subtype. Black walnut, hackberry, bur oak, soft maple, and boxelder, singly or in combination and growing in coves or bottomlands, must comprise a plurality of the stocking of the lowland plains hardwoods subtype. Elm, ash, cottonwood or willow, singly or in combination and growing on lowland sites must comprise a plurality of the stocking (except for those areas largely occupied by willow or cottonwood) to be classed by the subtype elm-ash-cottonwood.

Tree Classifications

All trees. — All live trees.

Growing stock trees. — Sawtimber trees, poletimber trees, saplings and seedlings. That is, all live trees except rough and rotten trees.

Desirable trees. — Growing stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest management in silvicultural operations.

Sawtimber trees. — Live trees of commercial species containing at least a 12-foot saw log. Softwoods must be at least 9.0 inches in diameter at breast height and hardwoods at least 11.0 inches.

Poletimber trees. — Live trees with good vigor and form of commercial species 5.0 to 8.9 inches in diameter at breast height for softwoods and 5.0 to 10.9 inches in diameter at breast height for hardwoods.

Saplings. — Live trees of commercial species 1.0 inch to 5.0 inches and of good form and vigor.

Seedlings. — Live trees of commercial species less than 1.0 inch in diameter at breast height that are expected to survive according to regional standards.

Rotten trees. — Live trees of commercial species that do not contain a merchantable 12-foot saw log, now or prospectively, because of rot.

Rough trees. — Live trees that do not contain at least one merchantable 12-foot saw log, now or prospectively, because of roughness, poor form, or noncommercial species.

Short-log trees (rough trees). — Trees that contain one or more 8- to 11-foot saw logs and would qualify as growing stock except for the 12-foot log requirement. Although these trees are merchantable, the net volume is shown separately from growing stock.

Area Condition Class

Excellent. — Areas 70 percent or more stocked with desirable trees.

Good. — Areas 40 to 70 percent stocked with desirable trees and with less than 30 percent of the area having undesirable growing stock trees, trees, inhibiting vegetation, or nonstockable c ditions.

Favorable. — Areas 40 to 70 percent stocked w desirable trees and with 30 percent or more of area having other trees or conditions that prev occupancy by desirable trees.

Moderately favorable. — Areas less than 40 p cent stocked with desirable trees, but with 70 perc or more of the area occupied by growing stock tr

Fair. — Areas less than 40 percent stocked w desirable trees, but with 40 to 70 percent of the a occupied by growing stock trees.

Unfavorable. — Areas less than 40 percent stoc with desirable trees, and with less than 40 perc of the area occupied by growing stock trees.

Other Land Classifications

Site index. — An expression of forest site qua based upon the height of a free-growing domin tree at age 50.

Stand-age. — Age of the main stand in both ev and uneven-aged stands.

Stocking. — An expression of how well the av able growing space is being utilized by trees, me ured by basal area and/or number of trees.

Timber Volumes

Volume of growing stock. — The volume of sou wood in the bole of sawtimber and poletimber tr from stump to a minimum 4.0-inch top diame outside bark, or to the point where the central st breaks into limbs. Growing stock volumes are sho in cubic feet but may be converted into solid-wc cords by dividing by 79.

Volume of sawtimber. — Net volume of the s log portion of live sawtimber trees in board fe International ¼-inch rule, from stump to a minimu 7 inches top diameter outside bark for softwo and 9 inches for hardwoods. Note that the volu of sawtimber is a part of the volume of growi stock.

Volume of short-log trees. — Net volume of saw log portion of short-log trees, International inch rule, from stump to a minimum 7 inches meter outside bark for softwoods and 9 inches for dwoods. Note that the volume of short-log trees shown separately from the volume of growing ck.

Jpper stem portion. — That part of the bole of timber trees above the merchantable top to a nimum top diameter of 4.0 inches outside bark to the point where the central stem breaks into bs.

g Grades

og grades. — The grades assigned to sawtimber es were based on external characteristics of all logs the tree in accordance with "Hardwood Log ade for Standard Lumber" issued by the Forest ducts Laboratory under the designation D1737 in 3, and standards for hardwood tie and timber s.

owth

et annual growth of growing stock. — The an- al change in volume of sound wood in live saw- ber and poletimber trees and the total volume of es entering these classes through ingrowth, less ume losses resulting from natural causes on com- rcial forest land.

et annual growth of sawtimber. — The annual nge in volume of live sawtimber trees and the al volume of trees reaching sawtimber size, less ume losses resulting from natural causes (meas- d in board feet, International ¼-inch rule).

ortality of growing stock. — The volume of nd wood in live sawtimber and poletimber trees ng annually from natural causes (averaged for a 3-year period). Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber. — The net board foot volume of sawtimber trees dying annually from natural causes (averaged for a 3-year period).

Trend growth. — Annual growth as defined above except that mortality estimates are averaged from a longer period of time.

Timber Cut

Timber cut from growing stock. — The volume of sound wood in live sawtimber and poletimber trees cut for forest products during a specified period including both roundwood products and logging residues. Roundwood products are logs, bolts, and other round sections cut from trees. Logging residues are the unused portions of growing stock trees plus unused growing stock trees killed by logging.

Timber cut from sawtimber. — The net board foot volume of live sawtimber trees cut for forest products during a specified period including both roundwood products and logging residues.

Timber products output. — All timber products produced from roundwood, and by-products of wood-manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing stock trees, cull trees, salvable dead trees, trees on nonforest land, trees of noncommercial species, sapling-size trees, and limbwood. By-products from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores, and clippings. The annual timber cut include roundwood products and logging residues but does not include output from nongrowing stock or plant by-products.

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Projections

51. Projections of timber volumes on commercial forest land, 1965 to 1995

Table 1.—*Land area by classes and Forest Survey Units, Kansas, 1965*
(In acres)

Land Class	All units	Northeastern	Southeastern	Western
Forest land:				
Commercial forest	1,192,400	540,600	491,200	160,600
Unproductive forest	157,400	23,400	119,400	14,600
Productive-reserved forest	-	-	-	-
Total forest land	1,349,800	564,000	610,600	175,200
Nonforest land:				
Cropland	29,476,900	4,341,900	3,839,500	21,295,500
Pasture and range	18,403,100	2,832,300	4,725,000	10,845,800
Wooded strips	214,600	99,100	61,800	53,700
Other 1/	3,066,300	651,700	651,100	1,763,500
Total nonforest land	51,160,900	7,925,000	9,277,400	33,958,500
All land 2/	52,510,700	8,489,000	9,888,000	34,133,700

1/ Includes 66,900 acres of water according to Survey standards, but defined by the Bureau of the Census as land.

2/ From the U.S. Bureau of the Census, Land and Water Area of the United States, 1960.

Table 2.—*Area of commercial forest land, by ownership classes and Forest Survey Units, Kansas, 1965*
(In acres)

Ownership Class	All units	Northeastern	Southeastern	Western
Miscellaneous Federal	26,600	21,200	5,400	-
State	8,400	6,100	2,300	-
County and municipal	1,500	1,500	-	-
Farmer-owned	803,900	367,100	315,000	121,800
Miscellaneous private	352,000	144,700	168,500	38,800
All ownerships	1,192,400	540,600	491,200	160,600

Table 3.—*Area of commercial forest land, by stand-size and ownership classes, Kansas, 1965*
(In acres)

Stand-size class	All ownerships	Public	Private
ALL UNITS			
Sawtimber	678,200	20,300	657,900
Poletimber	227,500	9,800	217,700
Sapling and seedling	139,500	1,900	137,600
Nonstocked	147,200	4,500	142,700
All classes	1,192,400	36,500	1,155,900
NORTHEASTERN UNIT			
Sawtimber	302,600	16,500	286,100
Poletimber	120,300	7,500	112,800
Sapling and seedling	60,200	1,900	58,300
Nonstocked	57,500	2,900	54,600
All classes	540,600	28,800	511,800
SOUTHEASTERN UNIT			
Sawtimber	276,800	3,800	273,000
Poletimber	78,400	2,300	76,100
Sapling and seedling	66,200	-	66,200
Nonstocked	69,800	1,600	68,200
All classes	491,200	7,700	483,500
WESTERN UNIT			
Sawtimber	98,800	-	98,800
Poletimber	28,800	-	28,800
Sapling and seedling	13,100	-	13,100
Nonstocked	19,900	-	19,900
All classes	160,600	-	160,600

Table 4.—*Area of commercial forest land by sawtimber volume and stand-size classes, Kansas, 1965*
(In acres)

Volume per acre (board feet) [1]	All stands	Sawtimber stands	Other stands
Less than 1,500	759,400	259,200	500,200
1,500 to 5,000	370,600	356,600	14,000
More than 5,000	62,400	62,400	-
Total	1,192,400	678,200	514,200

[1] Net volume, International 1/4-inch rule.

Table 5.—*Area of commercial forest land, by stocking classes based on alternative stand components, Kansas, 1965*
(In acres)

Stocking class (percent)	Stocking classified in terms of--		
	All trees	Growing stock trees	Desirable trees
100+	236,400	5,500	-
90-100	203,600	7,900	-
80-90	207,900	22,700	-
70-80	200,800	35,600	-
60-70	165,100	89,800	3,400
50-60	85,700	96,900	1,400
40-50	41,000	143,100	8,100
30-40	28,500	203,700	8,300
20-30	12,700	222,700	36,300
10-20	6,100	217,300	127,900
Less than 10	4,600	147,200	1,007,000
Total	1,192,400	1,192,400	1,192,400

Table 6.—*Area of commercial forest land, by stocking classes of growing stock trees and by stand-size classes, Kansas, 1965*
(In acres)

Stocking class (percent)	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 or more	71,700	60,400	9,300	2,000	-
40-70	329,800	221,700	79,000	29,100	-
10-40	643,700	396,100	139,200	108,400	-
Less than 10	147,200	-	-	-	147,200
All classes	1,192,400	678,200	227,500	139,500	147,200

Table 7.—*Area of commercial forest land, by area-condition and ownership classes, Kansas, 1965*
(In acres)

Area condition class	All ownerships	Public	Private
Favorable	12,900	-	12,900
Moderately favorable	58,800	-	58,800
Fair	329,800	8,200	321,600
Unfavorable	790,900	28,300	762,600
All classes	1,192,400	36,500	1,155,900

Table 8.—*Area of commercial forest land, by area-condition and stand-treatment classes, Kansas, 1965*
(In acres)

Area-condition class	All areas	No treatment	Commercial cut	Commercial stand improvement	Noncommercial stand improvement	Re-forestation
Favorable	12,900	200	4,600	4,400	3,700	-
Moderately favorable	58,800	4,800	27,500	23,500	3,000	-
Fair	329,800	91,900	90,800	103,300	41,800	2,000
Unfavorable	790,900	252,400	97,400	151,700	238,100	51,300
All classes	1,192,400	349,300	220,300	282,900	286,600	53,300

Table 9.—*Area of commercial forest land, by forest types and site index classes, Kansas, 1965*
(In acres)

Forest type	All sites	35-40	40-50	50-60	60-70	70-80	80-90	90-1
Oak-hickory:								
Redcedar-hdwds	4,100	-	4,100	-	-	-	-	
Post oak	31,100	3,700	11,500	10,400	-	3,900	1,600	
Oak-hickory	211,400	6,800	64,100	65,600	43,300	25,300	5,400	90
Elm-ash-locust	260,800	1,400	25,400	60,000	87,500	47,000	24,600	14,90
Upland plains hdwds	129,000	4,300	35,100	35,000	35,500	15,900	3,200	
Elm-ash-cottonwood:								
Cottonwood	74,200	-	8,900	29,000	26,100	4,500	4,600	1,10
Willow	9,900	3,600	-	700	1,400	2,500	1,700	
Lowland plains hdwds	251,800	-	9,200	47,600	77,000	59,100	39,900	19,00
Elm-ash-cottonwood	220,100	-	4,100	28,100	63,100	79,700	33,200	11,90
All types	1,192,400	19,800	162,400	276,400	333,900	237,900	114,200	47,80

Table 10.—*Area of commercial forest land, by forest types and ownership classes, Kansas, 1965*
(In acres)

Forest type	All ownerships	Public	Private
Oak-hickory:			
Redcedar-hardwoods	4,100	-	4,100
Post oak	31,100	-	31,100
Oak-hickory	211,400	5,200	206,200
Elm-ash-locust	260,800	8,700	252,100
Upland plains hardwoods	129,000	3,700	125,300
Total oak-hickory	636,400	17,600	618,800
Elm-ash-cottonwood:			
Cottonwood	74,200	4,800	69,400
Willow	9,900	-	9,900
Lowland plains hardwoods	251,800	6,500	245,300
Elm-ash-cottonwood	220,100	7,600	212,500
Total elm-ash-cottonwood	556,000	18,900	537,100
All types	1,192,400	36,500	1,155,900

Table 11—*Area of commercial forest land, by forest types and stand-size classes, Kansas, 1965*
(In acres)

Forest type	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Non-stocked stands
Oak-hickory:					
Redcedar hdwds	4,100	1,500	-	-	2,600
Post oak	31,100	6,100	17,900	7,100	-
Oak-hickory	211,400	127,400	41,700	20,500	21,800
Elm-ash-locust	260,800	106,100	56,300	39,100	59,300
Upland plains hdwds	129,000	38,900	41,600	25,200	23,300
Elm-ash-cottonwood:					
Cottonwood	74,200	42,700	19,600	4,000	7,900
Willow	9,900	5,400	3,100	1,200	200
Lowland plains hdwds	251,800	187,800	31,300	14,400	18,300
Elm-ash-cottonwood	220,100	162,300	16,000	28,000	13,800
All types	1,192,400	678,200	227,500	139,500	147,200

Table 12.—*Area of commercial forest land, by forest types and stand-age classes, Kansas, 1965*
(In acres)

Forest type	All ages	Age class (Years) 0-40	40-50	50-60	60-70	70-80	80-90	90-100	100-120	120-140
ALL UNITS										
Oak-hickory:										
Redcedar-hdwds	4,100	4,100	-	-	-	-	-	-	-	-
Post oak	31,100	22,000	7,400	-	1,700	-	-	-	-	-
Oak-hickory	211,400	76,200	36,900	21,300	31,000	20,000	14,300	3,400	6,800	1,500
Elm-ash-locust	260,800	166,000	31,100	30,600	14,100	8,200	9,100	1,700	-	-
Upland plains hdwds	129,000	90,300	21,200	6,400	6,200	-	2,900	-	2,000	-
Elm-ash-cottonwood:										
Cottonwood	74,200	47,100	9,200	7,800	7,600	-	-	2,500	-	-
Willow	9,900	5,900	4,000	-	-	-	-	-	-	-
Lowland plains hdwds	251,800	90,800	40,400	50,500	35,900	16,500	12,100	3,800	1,800	-
Elm-ash-cottonwood	220,100	84,500	35,000	32,700	27,800	21,400	12,200	1,300	5,200	-
All types	1,192,400	586,900	185,200	149,300	124,300	66,100	50,600	12,700	15,800	1,500
NORTHEASTERN UNIT										
Oak-hickory:										
Redcedar-hdwds	2,900	2,900	-	-	-	-	-	-	-	-
Post oak	1,700	1,700	-	-	-	-	-	-	-	-
Oak-hickory	129,400	47,000	21,900	11,600	15,400	10,600	11,200	3,400	6,800	1,500
Elm-ash-locust	106,000	70,700	9,600	17,400	4,600	1,400	2,300	-	-	-
Upland plains hdwds	72,600	50,300	15,800	1,500	3,300	-	1,700	-	-	-
Elm-ash-cottonwood:										
Cottonwood	22,600	9,100	4,400	4,200	3,300	-	-	1,600	-	-
Willow	400	400	-	-	-	-	-	-	-	-
Lowland plains hdwds	105,100	34,500	13,700	21,700	20,300	6,000	6,300	2,600	-	-
Elm-ash-cottonwood	99,900	31,800	17,800	7,800	13,900	17,900	6,800	1,300	2,600	-
All types	540,600	248,400	83,200	64,200	60,800	35,900	28,300	8,900	9,400	1,500
SOUTHEASTERN UNIT										
Oak-hickory:										
Redcedar-hdwds	1,200	1,200	-	-	-	-	-	-	-	-
Post oak	29,400	20,300	7,400	-	1,700	-	-	-	-	-
Oak-hickory	75,400	29,200	15,000	9,700	13,200	6,600	1,700	-	-	-
Elm-ash-locust	114,300	74,300	11,400	11,100	7,500	5,200	3,100	1,700	-	-
Upland plains hdwds	50,000	35,300	4,900	3,700	2,900	-	1,200	-	2,000	-
Elm-ash-cottonwood:										
Cottonwood	18,600	16,100	900	1,600	-	-	-	-	-	-
Willow	4,000	-	4,000	-	-	-	-	-	-	-
Lowland plains hdwds	117,200	46,500	21,200	22,300	15,600	6,300	2,300	1,200	1,800	-
Elm-ash-cottonwood	81,100	34,800	12,500	20,200	8,700	3,500	-	-	1,400	-
All types	491,200	257,700	77,300	68,600	49,600	21,600	8,300	2,900	5,200	-
WESTERN UNIT										
Oak-hickory:										
Redcedar-hdwds	-	-	-	-	-	-	-	-	-	-
Post oak	-	-	-	-	-	-	-	-	-	-
Oak-hickory	6,600	-	-	-	2,400	2,800	1,400	-	-	-
Elm-ash-locust	40,500	21,000	10,100	2,100	2,000	1,600	3,700	-	-	-
Upland plains hdwds	6,400	4,700	500	1,200	-	-	-	-	-	-
Elm-ash-cottonwood:										
Cottonwood	33,000	21,900	3,900	2,000	4,300	-	-	900	-	-
Willow	5,500	5,500	-	-	-	-	-	-	-	-
Lowland plains hdwds	29,500	9,800	5,500	6,500	-	4,200	3,500	-	-	-
Elm-ash-cottonwood	39,100	17,900	4,700	4,700	5,200	-	5,400	-	1,200	-
All types	160,600	80,800	24,700	16,500	13,900	8,600	14,000	900	1,200	-

Table 13.—*Area of commercial forest land, by forest types and area condition classes, Kansas, 1965*
(In acres)

Forest type	All area conditions	Favorable	Moderately favorable	Fair	Unfavorable
ALL UNITS					
Oak-hickory:					
Redcedar-hdwds	4,100	-	-	-	4,100
Post oak	31,100	2,000	1,700	11,500	15,900
Oak-hickory	211,400	1,700	18,400	72,900	118,400
Elm-ash-locust	260,800	2,800	3,700	43,000	211,300
Upland plains hdwds	129,000	-	7,400	29,400	92,200
Elm-ash-cottonwood:					
Cottonwood	74,200	1,400	6,200	24,700	41,900
Willow	9,900	200	-	5,200	4,500
Lowland plains hdwds	251,800	3,400	11,300	92,800	144,300
Elm-ash-cottonwood	220,100	1,400	10,100	50,300	158,300
All types	1,192,400	12,900	58,800	329,800	790,900
NORTHEASTERN UNIT					
Oak-hickory:					
Redcedar-hdwds	2,900	-	-	-	2,900
Post oak	1,700	-	-	1,700	-
Oak-hickory	129,400	-	11,100	45,400	72,900
Elm-ash-locust	106,000	1,000	2,000	14,900	88,100
Upland plains hdwds	72,600	-	7,400	20,100	45,100
Elm-ash-cottonwood:					
Cottonwood	22,600	-	4,400	5,500	12,700
Willow	400	200	-	-	200
Lowland plains hdwds	105,100	-	3,500	45,600	56,000
Elm-ash-cottonwood	99,900	1,400	5,700	18,500	74,300
All types	540,600	2,600	34,100	151,700	352,200
SOUTHEASTERN UNIT					
Oak-hickory:					
Redcedar-hdwds	1,200	-	-	-	1,200
Post oak	29,400	2,000	1,700	9,800	15,900
Oak-hickory	75,400	1,700	5,900	23,900	43,900
Elm-ash-locust	114,300	1,800	1,700	24,400	86,400
Upland plains hdwds	50,000	-	-	8,100	41,900
Elm-ash-cottonwood:					
Cottonwood	18,600	-	-	3,500	15,100
Willow	4,000	-	-	2,300	1,700
Lowland plains hdwds	117,200	3,400	6,000	37,600	70,200
Elm-ash-cottonwood	81,100	-	3,200	25,400	52,500
All types	491,200	8,900	18,500	135,000	328,800
WESTERN UNIT					
Oak-hickory:					
Redcedar-hdwds	-	-	-	-	-
Post oak	-	-	-	-	-
Oak-hickory	6,600	-	1,400	3,600	1,600
Elm-ash-locust	40,500	-	-	3,700	36,800
Upland plains hdwds	6,400	-	-	1,200	5,200
Elm-ash-cottonwood:					
Cottonwood	33,000	1,400	1,800	15,700	14,100
Willow	5,500	-	-	2,900	2,600
Lowland plains hdwds	29,500	-	1,800	9,600	18,100
Elm-ash-cottonwood	39,100	-	1,200	6,400	31,500
All types	160,600	1,400	6,200	43,100	109,900

Table 14.—*Area of land and forest land, by counties, Kansas, 1965*

County [1]	Land area	Forest land			Commercial forest as a percent of land area	Other non-forest land	
		All forest	Noncommercial	Commercial		Wooded pasture	Wooded strips
	(Acres)	(Acres)	(Acres)	(Acres)	(Percent)	(Acres)	(Acres)
NORTHEASTERN UNIT							
Aitchison	269,400	26,900	800	26,100	9.7	4,400	3,300
Brown	369,900	13,600	400	13,200	3.6	6,400	3,900
Clay Center	1,538,600	34,700	1,300	33,400	2.2	27,100	11,600
Doniphan	242,600	34,700	1,000	33,700	13.9	3,700	4,000
Douglas	299,500	33,800	1,200	32,600	10.9	4,800	3,000
Franklin	369,300	34,700	1,200	33,500	9.1	6,000	3,800
Jackson	419,800	25,100	900	24,200	5.8	7,000	7,600
Jefferson	351,400	46,300	1,600	44,700	12.7	5,500	5,900
Johnson-Wyandotte	400,700	38,200	1,600	36,600	9.1	6,600	3,500
Leavenworth	297,600	47,500	2,300	45,200	15.2	4,500	5,600
Manhattan	1,705,000	92,200	5,500	86,700	5.1	28,900	16,800
Marshall	583,000	26,900	800	26,100	4.5	9,900	9,700
Miami	378,200	43,300	1,700	41,600	11.0	6,000	4,500
Nemaha	453,800	17,300	1,400	15,900	3.5	7,800	7,300
Osage	461,400	27,800	1,000	26,800	5.8	7,800	4,700
Shawnee	348,800	21,000	700	20,300	5.8	5,900	3,900
Total	8,489,000	564,000	23,400	540,600	6.4	142,300	99,100
SOUTHEASTERN UNIT							
Allen	323,200	15,200	800	14,400	4.5	6,100	1,300
Anderson	369,300	23,000	2,200	20,800	5.6	6,900	1,300
Bourbon	409,000	53,300	11,000	42,300	10.3	7,000	1,500
Chautauqua	414,100	68,900	29,300	39,600	9.6	6,800	4,800
Cherokee	375,700	36,600	5,600	31,000	8.3	6,700	700
Coffey	419,800	16,400	1,200	15,200	3.6	8,000	3,000
Crawford	382,700	33,400	5,500	27,900	7.3	6,900	400
Eldorado	2,386,500	68,200	7,000	61,200	2.6	45,700	16,900
Elk	414,100	27,000	11,500	15,500	3.7	7,600	3,500
Emporia	2,106,900	56,300	3,500	52,800	2.5	40,600	10,400
Labette	418,600	29,700	4,400	25,300	6.0	7,700	2,400
Linn	387,200	56,800	10,000	46,800	12.1	6,500	1,700
Montgomery	415,400	42,600	12,300	30,300	7.3	7,300	5,700
Neosho	375,700	26,200	3,200	23,000	6.1	6,800	2,400
Wilson	367,300	35,000	7,700	27,300	7.4	6,500	3,100
Woodson	322,500	22,000	4,200	17,800	5.5	5,900	2,700
Total	9,888,000	610,600	119,400	491,200	5.0	183,000	61,800
WESTERN UNIT							
Colby	7,235,800	9,900	1,100	8,800	0.12	9,300	3,000
Concordia	1,953,900	39,800	3,100	36,700	1.88	2,500	10,100
Dodge City	4,718,100	8,300	900	7,400	0.15	6,100	2,500
Garden City	4,981,100	10,700	4,300	6,400	0.13	6,400	1,300
Great Bend	2,397,500	8,400	600	7,800	0.33	3,100	2,900
Hays	5,154,600	25,100	1,800	23,300	0.45	6,600	10,500
Hutchinson	2,183,000	21,000	1,300	19,700	0.90	2,800	7,200
Salina	1,847,700	19,000	600	18,400	1.00	2,300	7,100
Wichita	3,662,000	33,000	900	32,100	0.88	4,700	9,100
Total	34,133,700	175,200	14,600	160,600	0.47	43,800	53,700
STATE TOTALS	52,510,700	1,349,800	157,400	1,192,400	2.27	369,100	214,600

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[1] The more lightly wooded counties are grouped by county blocks which are named after prominent communities (see figure 1).

Table 15.—*Area of noncommercial forest land by forest types, Kansas, 1965*
(In acres)

Forest types	Unproductive areas 1/
Oak-hickory	138,100
Elm-ash-cottonwood	19,300
All types	157,400

1/ Little or no productive-reserved area.

Table 16.—*Area of wooded strips (nonforest land), by forest type and stand-size classes, Kansas, 1965*
(In acres)

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling	Non-stocked areas
Oak-hickory:					
Redcedar-hdwds	4,800	-	-	4,800	-
Post oak	-	-	-	-	-
Oak-hickory	3,100	1,500	-	1,600	-
Elm-ash-locust	29,000	-	10,100	12,500	6,400
Upland plains hdwds	5,000	-	3,300	1,700	-
Elm-ash-cottonwood:					
Cottonwood	8,500	8,500	-	-	-
Willow	11,300	-	9,700	1,600	-
Lowland plains hdwds	59,500	10,600	27,300	10,700	10,900
Elm-ash-cottonwood	93,400	12,100	28,100	43,000	10,200
All types	214,600	32,700	78,500	75,900	27,500

Table 17.—*Area of wooded strips (nonforest land), by stocking and stand-size classes, Kansas, 1965*
(In acres)

Stocking class (Percent)	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 or more	4,000	2,500	1,500	-	-
40-70	47,900	8,800	23,400	15,700	-
10-40	135,200	21,400	53,600	60,200	-
Less than 10	27,500	-	-	-	27,500
All classes	214,600	32,700	78,500	75,900	27,500

Table 18.—*Number of growing-stock trees on commercial forest land, by diameter and species classes, Kansas, 1965*
(In thousand trees)

Diameter classes	All species	Softwoods	Hardwoods
2	43,720	140	43,580
4	23,170	90	23,080
6	16,590	40	16,550
8	10,230	-	10,230
10	6,380	10	6,370
12	3,980	-	3,980
14	2,810	-	2,810
16	1,840	-	1,840
18	1,220	-	1,220
20	820	-	820
22	570	-	570
24+	1,250	-	1,250
All diameter classes	112,580	280	112,300

Table 19.—*Number of rough and rotten live and salvable dead trees on commercial forest land, by species and diameter classes, Kansas, 1965*
(In thousand trees)

Species and diameter class (inches)	Rough and rotten trees	Salvable dead trees
Softwoods:		
1.0 - 4.9	640	-
5.0 - 8.9	150	30
9.0 - 18.9	10	-
19.0 and larger	10	-
Total	810	30
Hardwoods:		
1.0 - 4.9	226,370	-
5.0 - 10.9	49,930	160
11.0 - 18.9	11,280	160
19.0 and larger	2,990	40
Total	290,570	360
All species	291,380	390

Table 20.—*Volume of timber on commercial forest land, by timber and species classes, Kansas, 1965*[1]
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock:			
Sawtimber:			
Saw log portion	310,800	70	310,730
Upper stem portion	54,840	10	54,830
Total sawtimber	365,640	80	365,560
Poletimber	123,820	130	123,690
Total growing stock	489,460	210	489,250
Short-log tree:			
Sawtimber	112,800	-	112,800
Poletimber	35,040	60	34,980
Total short-log tree	147,840	60	147,780
Other rough tree:			
Sawtimber	112,960	320	112,640
Poletimber	48,910	150	48,760
Total other rough tree	161,870	470	161,400
Rotten tree:			
Sawtimber	19,620	-	19,620
Poletimber	260	-	260
Total rotten tree	19,880	-	19,880
Salvable dead tree:			
Sawtimber	2/ 4,010	-	4,010
Poletimber	520	-	520
Total salvable dead tree	4,530	-	4,530
All classes	823,580	740	822,840

1/ Estimates of additional volume on unproductive forest land total 1,930 thousand cubic feet in trees 5.0 inches and larger d.b.h. including 70 thousand cubic feet of softwoods and 1,860 thousand cubic feet of hardwoods.

2/ Includes 9,930 thousand board feet in sawtimber trees.

Table 21.—*Volume of growing stock and sawtimber on commercial forest land, by ownership and species classes, Kansas, 1965*

Ownership class	All species	Softwoods	Hardwoods
GROWING STOCK			
(In thousand cubic feet)			
Public	20,340	-	20,340
Private	469,120	210	468,910
All ownerships	489,460	210	489,250
SAWTIMBER			
(In thousand board feet) [1/]			
Public	81,780	-	81,780
Private	1,726,850	240	1,726,610
All ownerships	1,808,630	240	1,808,390

[1/] International 1/4-inch rule.

Table 22.—*Volume of growing stock and sawtimber on commercial forest land, by stand-size and species classes, Kansas, 1965*

Stand-size class	All species	Softwoods	Hardwoods
GROWING STOCK			
(In thousand cubic feet)			
Sawtimber	393,370	210	393,160
Poletimber	77,360	-	77,360
Sapling and seedling	14,160	-	14,160
Nonstocked	4,570	-	4,570
All classes	489,460	210	489,250
SAWTIMBER			
(In thousand board feet) [1/]			
Sawtimber	1,659,920	240	1,659,680
Poletimber	92,780	-	92,780
Sapling and seedling	42,200	-	42,200
Nonstocked	13,730	-	13,730
All classes	1,808,630	240	1,808,390

[1/] International 1/4-inch rule.

Table 23.—*Volume of growing stock trees on commercial forest land, by species and diameter classes, Kansas, 1965*
(In thousand cubic feet)

Species	All diameters	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0 and larger
Softwoods:											
Redcedar	210	130	-	80	-	-	-	-	-	-	-
Total softwoods	210	130	-	80	-	-	-	-	-	-	-
Hardwoods:											
Select white oaks:											
Bur oak	35,960	660	1,100	1,540	2,530	4,070	4,200	4,600	4,480	3,400	9,380
Other select white oaks	11,200	1,280	1,700	1,770	1,730	1,610	1,340	1,040	310	110	310
Select red oaks	25,340	1,610	2,040	2,970	4,090	3,580	2,230	2,170	1,980	1,360	3,310
Other white oaks	10,210	1,990	1,740	2,040	2,320	990	920	140	-	70	-
Other red oaks	18,930	960	1,960	1,700	1,780	2,350	2,380	1,780	1,530	1,250	3,240
Hickory:											
Hickory	12,760	2,090	3,120	2,740	1,590	880	1,300	620	220	-	200
Pecan	7,830	260	130	590	770	940	1,030	620	370	1,040	2,080
Hard maple	2,200	190	530	270	260	510	340	-	-	-	100
Soft maple	8,770	130	460	1,020	790	940	710	1,250	840	610	1,990
Ash	34,780	4,020	5,190	4,830	5,310	4,600	3,320	2,170	1,570	880	2,890
Cottonwood	98,410	3,240	4,740	5,570	6,760	5,260	4,640	5,680	8,010	9,810	44,700
Basswood	3,520	50	380	350	380	590	570	400	150	240	410
Black walnut	35,790	2,970	4,860	6,870	5,020	6,520	4,260	2,530	1,280	600	880
Other eastern hardwoods:											
Elm	86,910	4,030	6,280	4,960	6,160	6,430	7,770	6,960	6,080	6,560	31,680
Hackberry	47,630	2,740	4,640	6,910	4,990	5,830	4,220	5,210	4,190	2,860	6,040
Sycamore	23,970	100	260	850	810	1,770	1,870	1,770	2,150	1,530	12,860
Willow	10,490	2,510	1,610	1,670	720	920	1,300	870	160	140	290
Black cherry	90	-	90	-	-	-	-	-	-	-	-
Other soft hardwoods	7,590	910	1,660	1,540	950	920	720	290	210	230	160
Other hard hardwoods	6,870	990	1,130	1,150	1,090	770	620	200	560	280	80
Total hardwoods	489,250	30,730	43,620	49,340	48,050	49,480	43,710	38,300	34,090	31,300	120,600
All species	489,460	30,860	43,620	49,420	48,050	49,180	43,710	38,300	34,090	31,300	120,600

Table 24.—*Volume of sawtimber on commercial forest land, by species and diameter classes, Kansas, 1965*
(In thousand board feet)[1]

Species	All diameters	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23 and larger
Softwoods:									
Redcedar	240	240	-	-	-	-	-	-	-
Total softwoods	240	240	-	-	-	-	-	-	-
Hardwoods:									
Select white oaks:									
Bur oak	167,900	-	13,050	19,180	20,730	23,550	23,490	18,220	49,680
Other select white oaks	29,860	-	6,620	7,280	6,750	5,410	1,970	540	1,290
Select red oaks	93,090	-	17,310	16,990	12,080	11,180	10,710	7,730	17,090
Other white oaks	17,630	-	7,610	4,500	4,530	760	-	230	-
Other red oaks	73,870	-	7,770	11,460	12,800	9,930	9,260	6,940	15,710
Hickory:									
Hickory	26,420	-	8,430	4,990	6,970	3,490	1,430	-	1,110
Pecan	36,470	-	3,630	5,410	5,970	3,210	1,790	5,770	10,690
Hard maple	5,490	-	1,200	2,250	1,570	-	-	-	470
Soft maple	29,460	-	1,510	3,200	3,280	5,090	3,620	2,750	10,010
Ash	94,530	-	17,140	20,740	16,750	11,680	8,340	4,630	15,250
Cottonwood	435,840	-	22,860	22,650	22,350	28,180	43,690	53,010	243,100
Basswood	14,480	-	1,530	2,980	2,990	2,210	1,100	1,300	2,370
Black walnut	95,260	-	17,550	29,520	20,930	12,970	6,500	3,280	4,510
Other eastern hardwoods:									
Elm	349,980	-	24,810	29,850	39,870	34,780	29,630	33,550	157,490
Hackberry	162,570	-	20,140	25,360	21,810	26,340	21,370	14,980	32,570
Sycamore	125,170	-	3,550	9,210	9,730	9,400	12,400	8,750	72,130
Willow	20,620	-	2,560	3,840	5,710	3,740	780	2,080	1,910
Black cherry	-	-	-	-	-	-	-	-	-
Other soft hardwoods	14,640	-	3,070	3,640	3,290	1,580	1,110	1,020	930
Other hard hardwoods	15,110	-	3,560	3,100	3,010	950	2,460	1,540	490
Total hardwoods	1,808,390	-	183,900	226,150	221,120	194,450	179,650	166,320	636,800
All species	1,808,630	240	183,900	226,150	221,120	194,450	179,650	166,320	636,800

1/ International 1/4-inch rule.

Table 25.—*Volume of sawtimber on commercial forest land by species and log grade*
Kansas, 1965
(In thousand board feet)[1]

Species	Log Grades				
	All grades	Grade 1	Grade 2	Grade 3	Tie & timber Grade 4
Softwoods:					
Redcedar	240	-	-	240	-
Total softwoods	240	-	-	240	-
Hardwoods:					
Select white oaks:					
Bur oak	167,900	32,160	34,440	69,270	32,030
Other select white oaks	29,860	7,820	3,470	10,240	8,330
Select red oaks	93,090	4,000	11,920	53,650	23,520
Other white oaks	17,630	-	3,200	7,800	6,630
Other red oaks	73,870	6,230	20,700	29,230	17,710
Hickory:					
Hickory	26,420	1,910	8,900	11,230	4,380
Pecan	36,470	11,710	9,160	11,000	4,600
Hard maple	5,490	570	1,600	1,390	1,930
Soft maple	29,460	4,770	7,990	13,000	3,700
Ash	94,530	24,400	27,890	29,310	12,930
Cottonwood	435,840	190,300	60,090	143,170	42,280
Basswood	14,480	3,940	7,480	2,760	300
Black walnut	95,260	25,470	33,870	32,500	3,420
Other eastern hardwoods:					
Elm	349,980	41,600	99,020	121,220	88,140
Hackberry	162,570	49,010	50,230	55,550	7,780
Sycamore	125,170	40,240	35,510	42,920	6,500
Willow	20,620	3,280	4,190	9,560	3,590
Black cherry	-	-	-	-	-
Other soft hardwoods	14,640	1,010	4,550	6,830	2,250
Other hard hardwoods	15,110	240	1,400	11,930	1,540
Total hardwoods	1,808,390	448,660	425,610	662,560	271,560
All species	1,808,630	448,660	425,610	662,800	271,560

1/ International 1/4-inch rule.

Table 26.—*Volume of growing stock on commercial forest land, by species and Forest Survey Units, Kansas, 1965*
(In thousand cubic feet)

Species	All units	Northeastern	Southeastern	Western
Softwoods:				
Redcedar	210	140	70	-
Total softwoods	210	140	70	-
Hardwoods:				
Select white oaks:				
Bur oak	35,960	15,660	12,190	8,110
Other select white oaks	11,200	8,310	2,890	-
Select red oaks	25,340	12,250	13,090	-
Other white oaks	10,210	2,260	7,950	-
Other red oaks	18,930	11,280	7,650	-
Hickory:				
Hickory	12,760	8,090	4,670	-
Pecan	7,830	440	7,390	-
Hard maple	2,200	160	2,040	-
Soft maple	8,770	5,410	3,290	70
Ash	34,780	9,010	18,800	6,970
Cottonwood	98,410	45,540	11,360	41,510
Basswood	3,520	3,370	150	-
Black walnut	35,790	23,340	11,820	630
Other eastern hardwoods:				
Elm	86,910	41,820	34,280	10,810
Hackberry	47,630	20,980	21,570	5,080
Sycamore	23,970	8,300	15,670	-
Willow	10,490	4,220	3,710	2,560
Black cherry	90	90	-	-
Other soft hardwoods	7,590	2,910	2,290	2,390
Other hard hardwoods	6,870	3,360	2,570	940
Total hardwoods	489,250	226,800	183,380	79,070
All species	489,460	226,940	183,450	79,070

Table 27.—*Volume of sawtimber on commercial forest land, by species and Forest Survey Units, Kansas, 1965*
(In thousand board feet)

Species	All units	Northeastern	Southeastern	Western
Softwoods:				
Redcedar	240	240	-	-
Total softwoods	240	240	-	-
Hardwoods:				
Select white oaks:				
Bur oak	167,900	67,390	60,480	40,030
Other select white oaks	29,860	21,390	8,470	-
Select red oaks	93,090	43,890	49,200	-
Other white oaks	17,630	4,440	13,190	-
Other red oaks	73,870	49,920	23,950	-
Hickory:				
Hickory	26,420	15,060	11,360	-
Pecan	36,470	1,470	35,000	-
Hard maple	5,490	470	5,020	-
Soft maple	29,460	19,130	10,000	330
Ash	94,530	23,360	52,220	18,950
Cottonwood	435,840	211,560	49,220	175,060
Basswood	14,480	13,380	1,100	-
Black walnut	95,260	56,880	35,400	2,980
Other eastern hardwoods:				
Elm	349,980	159,330	142,120	48,530
Hackberry	162,570	64,790	79,650	18,130
Sycamore	125,170	42,190	82,980	-
Willow	20,620	6,680	11,630	2,310
Black cherry	-	-	-	-
Other soft hardwoods	14,640	5,410	6,230	3,000
Other hard hardwoods	15,110	7,000	6,570	1,540
Total hardwoods	1,808,390	813,740	683,790	310,860
All species	1,808,630	813,980	683,790	310,860

Table 28.—*Volume of growing stock and sawtimber on commercial forest land, by counties and species classes, Kansas, 1965*

County1/	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Thousand bd. ft.	Thousand bd. ft.	Thousand bd. ft.
			NORTHEASTERN UNIT			
Atchison	12,130	10	12,120	44,270	30	44,240
Brown	5,230	-	5,230	19,140	-	19,140
Clay Center	14,730	10	14,720	53,780	-	53,780
Doniphan	14,500	10	14,490	50,850	-	50,850
Douglas	13,460	10	13,450	47,920	30	47,890
Franklin	13,770	10	13,760	49,860	30	49,830
Jackson	11,230	10	11,220	41,470	-	41,470
Jefferson	19,970	10	19,960	72,040	30	72,010
Johnson & Wyandotte	14,210	10	14,200	50,080	30	50,050
Leavenworth	18,890	10	18,880	68,130	30	68,100
Manhattan	33,580	10	33,570	118,830	-	118,830
Marshall	11,000	10	10,990	38,940	-	38,940
Miami	16,810	10	16,800	60,090	-	60,090
Nemaha	6,100	-	6,100	21,490	-	21,490
Osage	12,170	10	12,160	44,180	30	44,150
Shawnee	9,160	10	9,150	32,910	30	32,880
Total	226,940	140	226,800	813,980	240	813,740
			SOUTHEASTERN UNIT			
Allen	5,870	-	5,870	23,210	-	23,210
Anderson	8,380	-	8,380	32,170	-	32,170
Bourbon	15,440	10	15,430	56,870	-	56,870
Chautaugua	13,030	10	13,020	45,100	-	45,100
Cherokee	11,170	-	11,170	41,750	-	41,750
Coffey	6,220	-	6,220	23,990	-	23,990
Crawford	10,120	10	10,110	38,080	-	38,080
Eldorado	24,620	10	24,610	93,380	-	93,380
Elk	4,230	-	4,230	13,880	-	13,880
Emporia	21,900	10	21,890	83,710	-	83,710
Labette	10,270	-	10,270	39,140	-	39,140
Linn	16,750	10	16,740	61,750	-	61,750
Montgomery	10,310	10	10,300	37,150	-	37,150
Neosho	8,800	-	8,800	32,960	-	32,960
Wilson	9,700	-	9,700	35,770	-	35,770
Woodson	6,640	-	6,640	24,880	-	24,880
Total	183,450	70	183,380	683,790	-	683,790
			WESTERN UNIT			
Colby	3,780	-	3,780	13,870	-	13,870
Concordia	20,370	-	20,370	83,130	-	83,130
Dodge	3,600	-	3,600	13,430	-	13,430
Garden City	3,560	-	3,560	15,000	-	15,000
Great Bend	3,590	-	3,590	13,580	-	13,580
Hays	10,850	-	10,850	41,630	-	41,630
Hutchinson	9,150	-	9,150	34,860	-	34,860
Salina	8,690	-	8,690	34,350	-	34,350
Wichita	15,480	-	15,480	61,010	-	61,010
Total	79,070	-	79,070	310,860	-	310,860
State total	489,460	210	489,250	1,808,630	240	1,808,390

1/ The more lightly wooded counties are grouped by county blocks which are named after prominent communities (see figure 1).

Table 29.—*Volume of short-log trees on commercial forest land, by species and Forest Survey Units, Kansas, 1965*
(In thousand cubic feet)

Species	All units	Northeastern	Southeastern	Western
Softwoods:				
Redcedar	60	60	-	-
Total softwoods	60	60	-	-
Hardwoods:				
Select white oaks:				
Bur oak	13,720	5,930	5,310	2,480
Other select white oaks	5,720	4,160	1,560	-
Select red oaks	3,660	2,030	1,630	-
Other white oaks	3,430	710	2,720	-
Other red oaks	2,930	2,270	660	-
Hickory:				
Hickory	1,850	1,120	730	-
Pecan	1,420	80	1,340	-
Hard maple	330	-	330	-
Soft maple	3,200	2,140	1,060	-
Ash	10,090	2,380	5,120	2,590
Cottonwood	11,050	3,550	1,440	6,060
Basswood	960	890	-	70
Black walnut	8,600	5,250	2,940	410
Other eastern hardwoods:				
Elm	50,690	21,630	19,770	9,290
Hackberry	15,300	6,060	6,190	3,050
Sycamore	1,790	1,220	570	-
Willow	3,020	350	2,040	630
Black cherry	590	590	-	-
Other soft hardwoods	5,580	3,070	1,200	1,310
Other hard hardwoods	3,850	2,180	1,060	610
Total hardwoods	147,780	65,610	55,670	26,500
All species	147,840	65,670	55,670	26,500

Table 30.—*Sawtimber volume in short-log trees on commercial forest land, by species and Forest Survey Units, Kansas, 1965*
(In thousand board feet)[1]

Species	All units	Northeastern	Southeastern	Western
Hardwoods:				
Select white oaks:				
Bur oak	32,710	13,910	13,390	5,410
Other select white oaks	4,720	3,750	970	-
Select red oaks	7,090	4,360	2,730	-
Other white oaks	1,880	470	1,410	-
Other red oaks	7,000	5,530	1,470	-
Hickory:				
Hickory	2,180	1,370	810	-
Pecan	2,930	230	2,700	-
Hard maple	-	-	-	-
Soft maple	6,020	4,610	1,410	-
Ash	6,900	1,270	2,770	2,860
Cottonwood	27,160	9,520	1,660	15,980
Basswood	1,740	1,740	-	-
Black walnut	10,440	6,170	3,760	510
Other eastern hardwoods:				
Elm	110,130	45,110	42,780	22,240
Hackberry	20,980	8,990	7,610	4,380
Sycamore	5,890	4,320	1,570	-
Willow	4,900	310	3,550	1,040
Black cherry	680	680	-	-
Other soft hardwoods	3,250	870	1,100	1,280
Other hard hardwoods	3,660	2,070	1,130	460
Total hardwoods	260,260	115,280	90,820	54,160
All species	260,260	115,280	90,820	54,160

[1] International 1/4-inch rule.

Table 31.—*Volume of timber on wooded strips (nonforest land), by timber and species classes, Kansas, 1965*
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock:			
Sawtimber			
Saw log portion	78,880	190	78,690
Upper stem portion	3,060	40	3,020
Total sawtimber	81,940	230	81,710
Poletimber	16,050	190	15,860
Total growing stock	97,990	420	97,570
Rough tree (including short log trees):			
Sawtimber	61,490	700	60,790
Poletimber	21,080	70	21,010
Total	82,570	770	81,800
Rotten tree:			
Sawtimber	2,230	-	2,230
Poletimber	960	120	840
Total	3,190	120	3,070
All classes	183,750	1,310	182,440

Table 32.—*Volume of growing stock and sawtimber on wooded strips (nonforest land), by stand-size and species classes, Kansas, 1965*

Stand-size class	All species	Softwoods	Hardwoods
GROWING STOCK (In thousand cubic feet)			
Sawtimber	42,780	-	42,780
Poletimber	34,740	-	34,740
Sapling and seedling	18,490	420	18,070
Nonstocked	1,980	-	1,980
All classes	97,990	420	97,570
SAWTIMBER (In thousand board feet) [1]			
Sawtimber	186,600	-	186,600
Poletimber	102,650	-	102,650
Sapling and seedling	80,670	-	80,670
Nonstocked	5,070	-	5,070
All classes	374,990	-	374,990

[1] International 1/4-inch rule.

Table 33.—*Volume of growing stock and short-log trees on wooded strips (nonforest land) by species and Forest Survey Units, Kansas, 1965*
(In thousand cubic feet)

Species	All units	North-eastern	South-eastern	Western
Softwoods:				
Redcedar	420	-	-	420
Total softwoods	420	-	-	420
Hardwoods:				
Select white oaks:				
Bur oak	2,040	250	1,790	-
Other select white oaks	90	90	-	-
Select red oaks	1,220	20	1,200	-
Other red oaks	2,210	1,680	530	-
Hickory	640	380	260	-
Soft maple	1,960	1,850	110	-
Ash	11,210	3,420	5,380	2,410
Cottonwood	42,870	19,120	5,290	18,460
Black walnut	4,070	2,770	1,300	-
Other eastern hardwoods:				
Elm	40,150	16,910	19,980	3,260
Hackberry	8,770	3,850	4,300	620
Sycamore	2,080	660	1,420	-
Willow	6,140	1,500	140	4,500
Other soft hardwoods	1,870	1,540	100	230
Other hard hardwoods	4,390	2,690	1,500	200
Total hardwoods	129,710	56,730	43,300	29,680
All species	130,130	56,730	43,300	30,100

Table 34.—*Volume of sawtimber material and short-log trees on wooded strips (nonforest land) by species and Forest Survey Units, Kansas, 1965*
(In thousand board feet)[1]

Species	All units	North-eastern	South-eastern	Western
Hardwoods:				
Select white oaks:				
Bur oak	9,180	990	8,190	-
Select red oaks	4,230	-	4,230	-
Other red oaks	9,740	7,710	2,030	-
Hickory	1,300	630	670	-
Soft maple	7,070	7,070	-	-
Ash	38,640	10,720	22,130	5,790
Cottonwood	191,410	81,770	20,490	89,150
Black walnut	8,200	5,380	2,820	-
Other eastern hardwoods:				
Elm	132,270	50,140	73,600	8,530
Hackberry	17,870	10,650	6,430	790
Sycamore	6,320	2,830	3,490	-
Willow	3,750	1,020	-	2,730
Other soft hardwoods	1,150	1,150	-	-
Other hard hardwoods	11,420	7,430	3,990	-
Total hardwoods	442,550	187,490	148,070	106,990
All species	442,550	187,490	148,070	106,990

[1] International 1/4-inch rule.

ble 35.—*Volume of growing stock trees on wooded strips (nonforest land), by species and diameter classes, Kansas, 1965*
(In thousand cubic feet)

Species	All diameters	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-19.9	19.0-20.9	21.0-22.9	23+
woods:											
edcedar	420	70	120	230	-	-	-	-	-	-	-
Total softwoods	420	70	120	230	-	-	-	-	-	-	-
woods:											
elect white oaks:											
Bur oak	1,760	-	40	-	-	480	-	460	-	780	-
elect red oaks	530	20	-	-	-	-	-	510	-	-	-
ther red oaks	1,780	-	20	-	-	80	-	440	-	-	1,240
ickory	170	20	150	-	-	-	-	-	-	-	-
oft maple	1,390	30	140	-	-	-	-	-	1,220	-	-
sh	8,650	430	830	550	700	-	420	950	550	790	3,430
ottonwood	39,670	540	570	1,420	2,710	3,170	5,000	1,380	750	10,260	13,870
asswood	110	20	-	90	-	-	-	-	-	-	-
lack walnut	2,760	220	270	400	980	540	350	-	-	-	-
ther eastern hardwoods:											
Elm	26,760	870	1,380	850	1,330	1,690	3,420	1,410	770	1,370	13,670
Hackberry	4,760	620	1,000	520	1,220	490	320	-	590	-	-
Sycamore	2,080	20	-	-	-	-	-	-	640	1,420	-
Willow	4,380	1,170	1,020	1,480	710	-	-	-	-	-	-
Black cherry	300	-	100	-	-	200	-	-	-	-	-
Other soft hardwoods	620	190	310	120	-	-	-	-	-	-	-
Other hard hardwoods	1,850	110	70	270	210	840	350	-	-	-	-
Total hardwoods	97,570	4,260	5,900	5,700	7,860	7,490	9,860	5,150	4,520	14,620	32,210
species	97,990	4,330	6,020	5,930	7,860	7,490	9,860	5,150	4,520	14,620	32,210

Table 36.—*Volume of sawtimber*[1] *on wooded strips (nonforest land), by species and diameter classes, Kansas, 1965*
(In thousand board feet)

Species	All diameters	Diameter class (inches at breast height) 11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23+
ardwoods:[2]								
Select white oaks:								
Bur oak	8,480	-	1,920	-	2,450	-	4,110	-
Select red oaks	2,180	-	-	-	2,180	-	-	-
Other red oaks	8,030	-	320	-	1,900	-	-	5,810
Soft maple	5,370	-	-	-	-	5,370	-	-
Ash	34,400	2,550	-	1,760	4,120	2,420	3,570	19,980
Cottonwood	181,120	11,120	13,340	22,590	6,070	3,300	48,560	76,140
Black walnut	6,630	3,410	2,090	1,130	-	-	-	-
Other eastern hardwoods:								
Elm	102,640	5,320	6,830	14,190	6,040	4,060	6,150	60,050
Hackberry	10,450	4,560	1,970	1,390	-	2,530	-	-
Sycamore	6,320	-	-	-	-	2,830	3,490	-
Willow	2,850	2,850	-	-	-	-	-	-
Black cherry	840	-	840	-	-	-	-	-
Other hardwoods	5,680	820	3,400	1,460	-	-	-	-
Total hardwoods	374,990	30,630	30,710	42,520	22,760	20,510	65,880	161,980

[1] Sawtimber growing stock (not including the volume of short-log trees)
[2] Little or no softwood sawtimber.

Table 37.—*Volume of black walnut, by material and land classes, Kansas, 1965*

Class of material	Commercial forest		Nonforest			
			Wooded strip		Other nonforest	
	Thousand cu. ft.	Thousand[1/] bd. ft.	Thousand cu. ft.	Thousand[1/] bd. ft.	Thousand cu. ft.	Thousand[1/] bd. ft.
Growing stock	35,790	-	2,760	-	860	-
Sawtimber	-	95,260	-	6,630	-	2,440
Short-logs trees	8,600	10,440	1,310	1,570	990	2,700
Other rough and rotten trees	6,990	[2/]	720	[2/]	2,110	[2/]
Total	51,380	105,700	4,790	8,200	3,960	5,140

[1/] International 1/4-inch rule.
[2/] Not expressed in board feet.

le 38.—*Net annual growth and annual removal of growing stock on commercial forest land, by species and Forest Survey Units, Kansas, 1964*
(In thousand cubic feet)

Species	Net annual growth				Net annual removal			
	All units	North-eastern	South-eastern	Western	All units	North-eastern	South-eastern	Western
rent growth and timber cut:								
oftwoods:								
Redcedar	40	30	10	-	20	10	10	-
Total softwoods	40	30	10	-	20	10	10	-
ardwoods:								
Select white oaks:								
Bur oak	1,010	540	280	190	760	380	290	90
Other select white oaks	540	370	170	-	60	10	50	-
Select red oaks	1,160	550	610	-	20	10	10	-
Other white oaks	610	90	520	-	240	50	190	-
Other red oaks	980	420	560	-	390	180	210	-
Hickory:								
Hickory	1,040	710	330	-	470	220	270	-
Pecan	360	30	330	-	30	10	20	-
Hard maple	100	30	70	-	-	-	-	-
Soft maple	470	270	200	-	620	310	190	120
Ash	2,630	650	1,540	440	420	160	220	40
Cottonwood	5,630	2,300	880	2,450	590	300	270	20
Basswood	150	150	-	-	-	-	-	-
Black walnut	2,440	1,600	810	30	1,180	780	300	100
Other eastern hardwoods:								
Elm	1,120	240	850	30	380	100	280	-
Hackberry	3,150	1,430	1,380	340	370	90	240	40
Sycamore	1,010	370	640	-	130	30	100	-
Willow	1,030	510	250	270	10	10	-	-
Black cherry	30	30	-	-	-	-	-	-
Other soft hardwoods	650	160	170	320	-	-	-	-
Other hard hardwoods	360	140	90	130	170	20	50	100
Total hardwoods	24,470	10,590	9,680	4,200	5,840	2,640	2,690	510
species	24,510	10,620	9,690	4,200	5,860	2,650	2,700	510
astrophic mortality or ther removals (all species)	10,330	4,750	3,930	1,650	2,300	1,050	870	380
nd growth and emoval (all species) 1/	14,180	5,870	5,760	2,550	8,160	3,700	3,570	890

/ Same as net annual growth and removal except that mortality estimates are averaged from a longer iod of time.

Table 39.—*Net annual growth and annual cut of growing stock on commercial forest land, by species and ownership classes, Kansas, 1964*
(In thousand cubic feet)

Species class	All owners	Public	Private
NET ANNUAL GROWTH			
Hardwoods 1/	2/ 24,510	1,050	23,460
ANNUAL TIMBER CUT			
Softwoods	20	-	20
Hardwoods	3/ 5,860	50	5,810
All species	5,880	50	5,830

1/ Little or no softwood growth.
2/ Trend growth is estimated to be 14,180 thousand cubic feet.
3/ Total removals are estimated to be 8,160 thousand cubic feet.

Table 40.—*Net annual growth and annual removal of sawtimber on commercial forest land, by species and Forest Surve Units, Kansas, 1964*
*(In thousand board feet)*1

Species	Net annual growth				Net annual removal			
	All units	North-eastern	South-eastern	Western	All units	North-eastern	South-eastern	Weste
Current growth and timber cut:								
Hardwoods: 2/								
Select white oaks:								
Bur oak	4,760	2,280	1,490	990	3,480	1,530	1,670	28
Other select white oaks	1,550	920	630	-	480	70	410	-
Select red oaks	4,600	1,820	2,780	-	100	50	50	-
Other white oaks	1,150	230	920	-	480	110	370	-
Other red oaks	3,180	1,810	1,370	-	1,400	620	780	-
Hickory:								
Hickory	1,960	1,290	670	-	1,440	550	890	-
Pecan	1,450	130	1,320	-	230	70	130	3
Hard maple	300	10	290	-	-	-	-	-
Soft maple	1,890	1,080	800	10	2,710	1,380	730	60
Ash	6,520	1,730	3,510	1,280	1,480	470	920	9
Cottonwood	22,560	10,870	3,570	8,120	3,860	1,900	1,790	17
Basswood	650	630	20	-	-	-	-	-
Black walnut	9,120	6,230	2,800	90	7,240	4,790	1,850	60
Other eastern hardwoods:								
Elm	5,470	1,250	3,550	670	2,280	620	1,640	2
Hackberry	10,840	5,680	4,330	830	2,230	550	1,440	24
Sycamore	4,390	1,520	2,870	-	810	200	610	-
Willow	1,720	1,110	280	330	-	-	-	-
Other soft hardwoods	1,550	490	310	750	-	-	-	-
Other hard hardwoods	1,460	730	570	160	510	50	190	27
Total hardwoods	85,120	39,810	32,080	13,230	28,730	12,960	13,470	2,30
Catastrophic mortality or other removals (all species)	39,580	17,810	15,040	6,730	6,400	2,880	2,440	1,080
Trend growth and removal (all species) 3/	45,540	22,000	17,040	6,500	35,130	15,840	15,910	3,380

1/ International 1/4-inch rule.
2/ Little or no softwood growth or cut.
3/ Same as net annual growth and removal except that mortality estimates are averaged from a longer period of time.

Table 41.—*Net annual growth and annual cut of hardwood sawtimber on commercial forest land by ownership class, Kansas, 1964*
(In thousand board feet)[1]

Species class	All species	Public	Private
NET ANNUAL GROWTH			
Hardwoods [2]	[3] 85,120	4,360	80,760
ANNUAL TIMBER CUT			
Hardwoods [2]	[4] 28,730	290	28,440

[1] International 1/4-inch rule.

[2] Little or no softwood growth or cut.

[3] Trend growth is estimated to be 45,540 thousand board feet.

[4] Total removals are estimated to be 35,130 thousand board feet.

Table 42.—*Annual mortality of growing stock and sawtimber on commercial forest land, by species, Kansas, 1964*

Species	Growing stock	Sawtimber
	Thousand cu. ft.	Thousand bd. ft. [1]
Hardwoods:[2]		
Select white and red oaks	160	260
Other white and red oaks	20	50
Hickory	30	60
Ash, walnut, black cherry	250	270
Other hardwoods	[3] 2,820	[3] 6,420
Total hardwoods	[4] 3,280	[4] 7,060

[1] International 1/4-inch rule.

[2] Little or no softwood mortality.

[3] Elm included 2,240,000 cubic feet and 5,440,000 board feet.

[4] Trend mortality is estimated at 13,610 thousand cubic feet including 46,640 thousand board feet.

Table 43.—*Annual mortality of hardwood growing stock and sawtimber on commercial forest land, by ownership class, Kansas, 1964*

Ownership class	Hardwoods 1/
GROWING STOCK (In thousand cubic feet)	
Public	190
Private	3,090
All ownerships	3/ 3,280
SAWTIMBER (In thousand board feet) 2/	
Public	470
Private	6,590
All ownerships	3/ 7,060

1/ Little or no softwood mortality.
2/ International 1/4-inch rule.
3/ Trend mortality is estimated at 13,610 thousand cubic feet including 46,640 thousand board feet.

Table 44.—*Annual mortality of hardwood growing stock and sawtimber on commercial forest land, by causes, Kansas, 1964*

Cause of death	Hardwoods 1/
GROWING STOCK (In thousand cubic feet)	
Fire	70
Disease	2,750
Other and unknown	460
All causes	3/ 3,280
SAWTIMBER (In thousand board feet) 2/	
Fire	50
Disease	6,680
Other and unknown	330
All causes	3/ 7,060

1/ Little or no softwood mortality.
2/ International 1/4-inch rule.
3/ Trend mortality is estimated at 13,610 thousand cubic feet including 46,640 thousand board feet.

Table 45.—*Total output of timber products by type of material used and species classes, Kansas, 1964*

Product and species class	Std. units of measure [1]	Total output [2]		Output from roundwood						Output from plant by-products	
				Total		From growing stock		From nongrowing stock			
		Std. units	Thousand cu. ft.	Std. units	Thousand cu. ft.	Std. units	Thousand cu. ft.	Std. units	Thousand cu. ft.	Std. units	Thousand cu. ft.
HARDWOODS:											
Saw logs and bolts	M bd. ft.	16,497	2,505	16,497	2,505	16,082	2,442	415	63	-	-
Veneer logs and bolts	M bd. ft.	3,467	507	3,467	507	3,310	484	157	23	-	-
Cooperage logs and bolts	M bd. ft.	1,893	258	1,893	258	1,798	245	95	13	-	-
Pulpwood	M cords	0.5	37	0.5	37	0.4	31	0.1	6	-	-
Mine timbers (round)	M cu. ft.	2	2	2	2	2	2	-	-	-	-
Miscellaneous industrial wood [3]	M cu. ft.	644	644	352	352	230	230	122	122	292	292
Posts (round and split)	M pieces	530	225	530	225	228	97	302	128	-	-
Fuelwood	M cords	71	4,524	68	4,343	30	1,937	38	2,406	3	181
SOFTWOODS:											
Posts (round and split)	M pieces	30	18	30	18	20	14	10	4	-	-
ALL PRODUCTS:											
Softwoods	M cu. ft.	-	18	-	18	-	14	-	4	-	-
Hardwoods	M cu. ft.	-	8,702	-	8,229	-	5,468	-	2,761	-	473
Total	M cu. ft.	-	8,720	-	8,247	-	5,482	-	2,765	-	473

[1] M (thousand) board feet are measured by International 1/4-inch rule.

[2] Timber cut figures, shown elsewhere, include output from growing stock and logging residues but not output from nongrowing stock and plant residues.

[3] Includes charcoal wood, handle bolts, farm timber, poles, etc.

Table 46.—*Total output of roundwood products, by source and species classes, Kansas, 1964*
(In thousand cubic feet)

Source	All species	Softwoods	Hardwoods
Growing stock trees:[1]			
Sawtimber	4,360	2	4,358
Poletimber	1,122	12	1,110
Total	5,482	14	5,468
Rough and rotten trees [1]	1,058	-	1,058
Salvable dead trees[1]	89	-	89
Other sources [2]	1,618	4	1,614
All sources	8,247	18	8,229

[1] On commercial forest land

[2] Includes noncommercial forest land, nonforest land (such as fence rows), trees less than 5.0 inches in diameter and limbwood.

Table 47.—*Annual timber removal from growing stock on commercial forest land, by products and logging residues, and species classes, Kansas, 1964*
(In thousand cubic feet)

Product and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	2,442	-	2,442
Veneer logs and bolts	484	-	484
Cooperage logs and bolts	245	-	245
Pulpwood	31	-	31
Mine timbers	2	-	2
Miscellaneous industrial wood [1]	230	-	230
Posts	111	14	97
Fuelwood	1,937	-	1,937
All products	5,482	14	5,468
Logging residues	378	-	378
Timber cut	5,860	14	5,846
Other removals	2,300	-	2,300
Total removals	8,160	14	8,146

[1] Includes charcoal wood, handle bolts, farm timbers, etc.

Table 48.—*Annual timber removals from live sawtimber on commercial forest land, by products and logging residues, and species classes, Kansas, 1964*
(In thousand board feet)[1]

Product and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs and bolts	15,497	4	15,493
Veneer logs and bolts	3,333	-	3,333
Cooperage logs and bolts	1,784	-	1,784
Pulpwood	36	-	36
Mine timbers	2	-	2
Miscellaneous industrial wood[2]	950	-	950
Posts	33	-	33
Fuelwood	5,345	-	5,345
All products	26,980	4	26,976
Logging residues	1,750	-	1,750
Timber cut	28,730	4	28,726
Other removals	6,400	-	6,400
Total removals	35,130	-	35,130

1/ International 1/4-inch rule.
2/ Includes charcoal wood, handle bolts, farm timbers, etc.

Table 49.—*Volume of unused plant residues, by industrial sources and type of residue, Kansas, 1964*
(In thousand cubic feet)

Industrial source	Species class and character of residues		
	Hardwoods 1/		
	Total	Coarse 2/	Fine 3/
Lumber industry	963	660	303
Other primary industries	66	40	26
Total	1,029	700	329

1/ Little or no softwood
2/ Unused material suitable for chipping, such as slabs, edging, and veneer cores.
3/ Unused material not suitable for chipping, such as sawdust and shavings.

Table 50.—*Number of primary wood-using plants, by Forest Survey Units, Kansas, 1964*

Kind of mill 1/	All units	North-eastern	South-eastern	Western
Sawmills:				
Small 2/	73	35	31	7
Medium 3/	6	4	2	-
Cooperage mills	10	3	6	1
Charcoal plants	1	-	1	-
Miscellaneous plants 4/	5	1	4	-
Total	95	43	44	8

1/ Excludes idle mills.
2/ Annual lumber output less than 1 million board feet.
3/ Annual lumber output from 1 million to 5 million board feet.
4/ Includes: Fence post concentration yards, treating plant.

Table 51.—*Projections of timber volumes on commercial forest land, Kansas, 1965 to 1995* 1

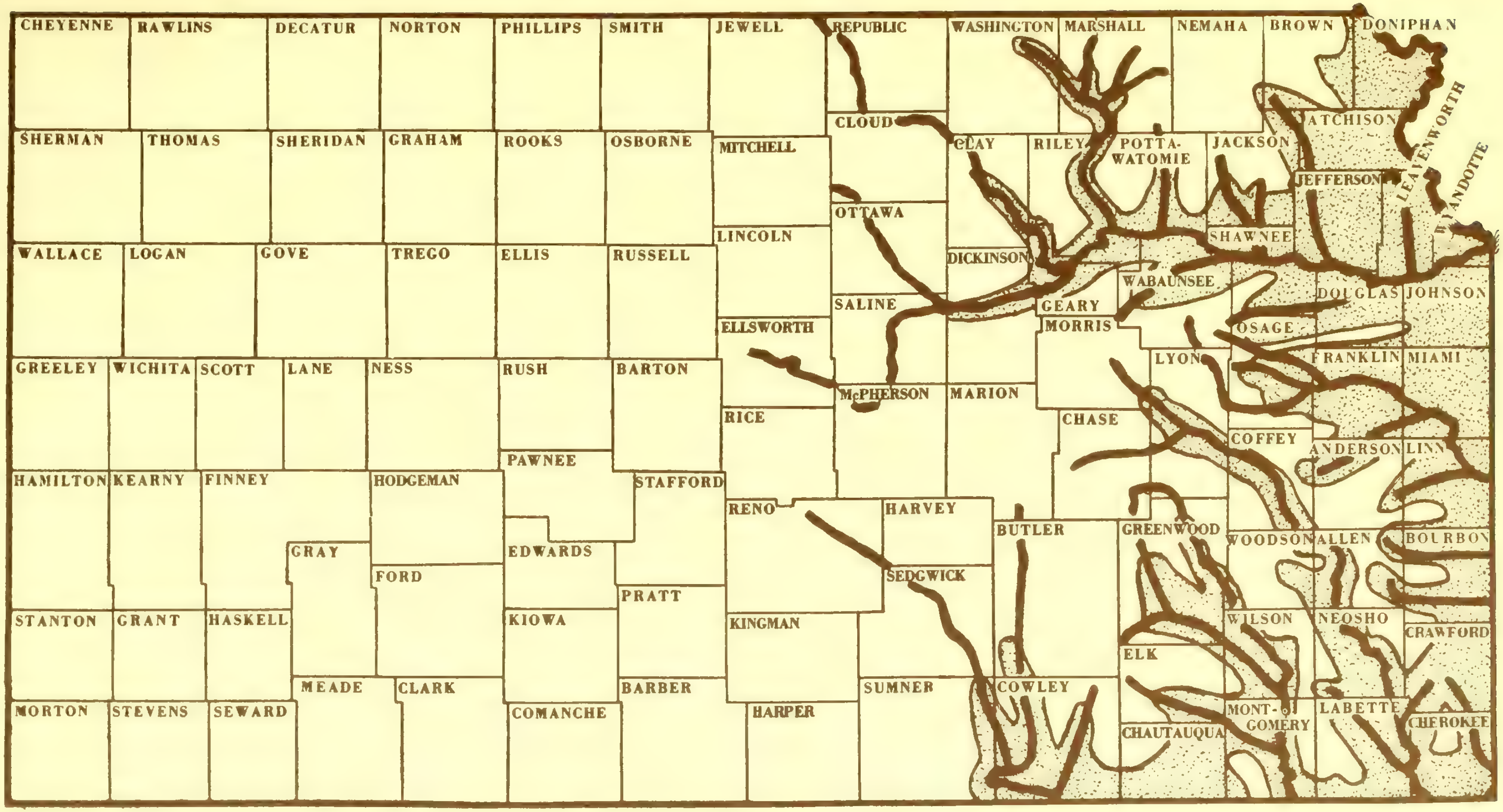
Year	Timber removal 2/			Trend growth 3/			Projected inventory		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoo
GROWING STOCK									
(In thousand cubic feet)									
1965	8,160	20	8,140	14,180	40	14,140	489,460	210	489,2
1975	8,900	20	8,880	14,800	40	14,760	549,100	400	548,7
1985	11,000	20	10,980	16,000	40	15,960	603,600	600	603,0
1995	13,200	20	13,180	18,400	40	18,360	654,600	800	653,8
SAWTIMBER									
(In thousand board feet) 4/									
1965	35,130	-	35,130	45,540	-	45,540	1,808,630	240	1,808,3
1975	41,000	-	41,000	48,400	-	48,400	1,897,400	300	1,897,1
1985	49,600	-	49,600	53,200	-	53,200	1,952,400	300	1,952,1
1995	57,600	-	57,600	59,700	-	59,700	1,980,900	300	1,980,6

1/ The outlook for timber volume, growth and cut to 1995 is based on assumptions that:
(A) The area of land used for producing timber will level off during the next 20 years and then begin a gradual decline.
(B) Mortality losses will continue to be substantial due to the large volume of mature timber, to recurring droughts, and to the advancing Dutch elm disease.
(C) Intensity of forest management will increase slowly but net growth rate will decline as stands fill in.
(D) Wood will maintain its relative position in the national economy but the demand for timber products from Kansas will increase.
(E) Annual production of sawtimber in Kansas will gradually increase until timber removal equals timber increment by about the year 2020. Annual production from small roundwood will also increase, but at a slower rate.

2/ Timber removal includes volume "lost" due to land clearing, flooding or reclassifying land use, in addition to cut volume.

3/ Trend growth is annual gross growth reduced for average (not current) mortality.

4/ International 1/4-inch rule.



FOREST TYPE GROUPS, KANSAS

NORTH CENTRAL FOREST EXPERIMENT STATION

1965

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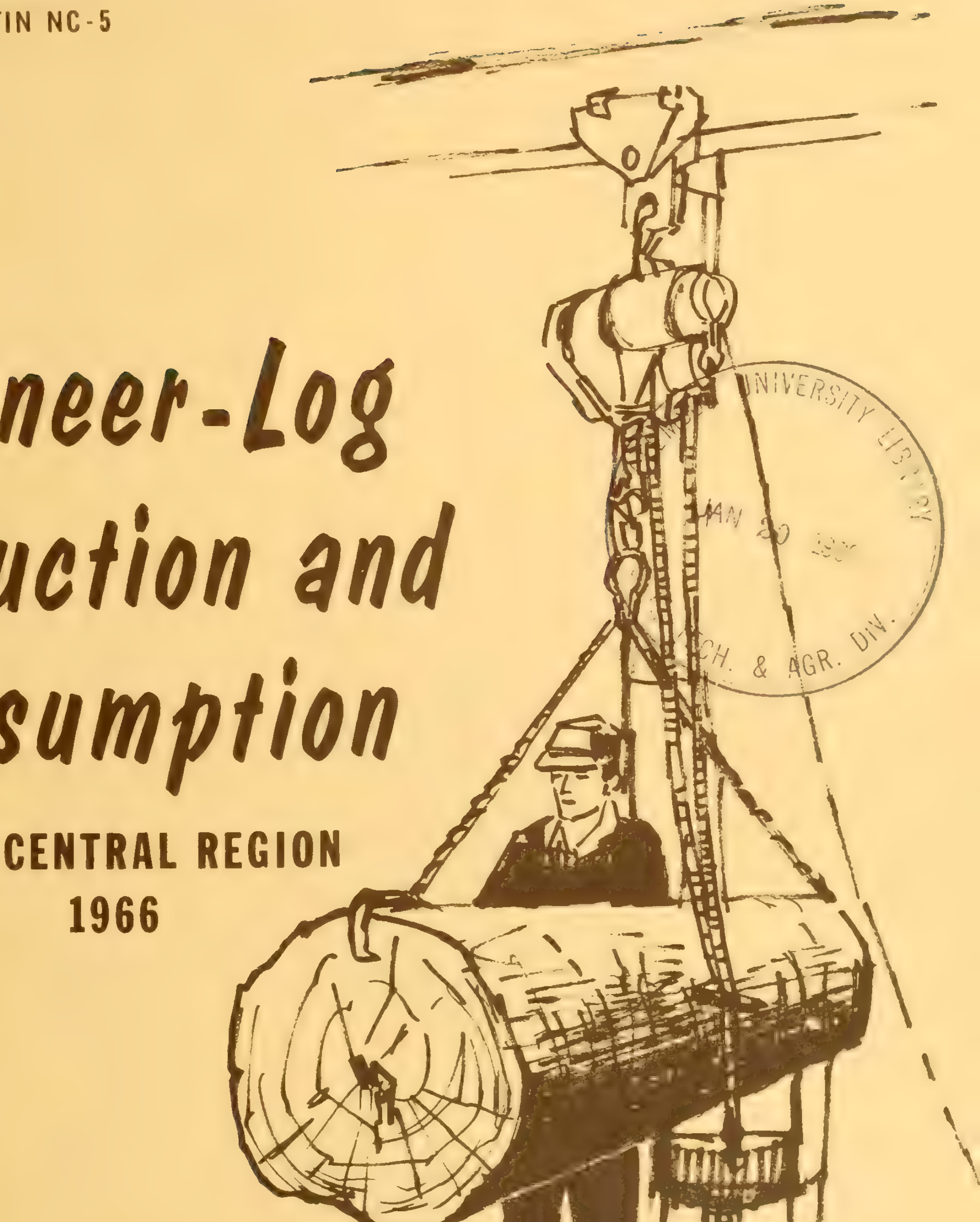
Veneer-Log Production and Consumption

NORTH CENTRAL REGION
1966



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Veneer-Log Production and Consumption North Central Region, 1966

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JAMES E. BLYTH, the author, is Market Analyst at the Station's Headquarters Laboratories in St. Paul, Minn. (The Station is maintained in cooperation with the University of Minnesota.)

NORTH CENTRAL FOREST EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE — FOREST SERVICE
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S. PAUL, MINNESOTA 55101

Sheets of rotary-cut veneer coming off lathe.

F-500478

Veneer-Log Production and Consumption North Central Region, 1966

JAMES E. BLYTH

All veneer mills using North Central Re-ion (Lake States and Central States) timber 1966 furnished figures showing their eneer-log receipts by species and state of rigin. Their cooperation is gratefully ack-owledged.

The Lake States (Minnesota, Wisconsin, nd Michigan) and Central States (Indiana, llinois, Iowa, and Missouri) are treated sep-rately in this report because the timber types each area are different. Moreover, less in-ormation can be released about the Central tates, because more detailed data on veneer-og production and consumption would reveal he operations of individual mills. This paper oes not include data on exports except to anada.

Seventy-nine veneer mills were operating uring 1966 in the North Central Region (fig.): Thirty-five were container veneer mills nd the others manufactured face, core, cross-and, or specialty veneers. Veneer mills are specially abundant in northeastern Wiscon-in and southern Indiana. These areas contain everal large mills producing high-quality ace and specialty veneers. As a result, both f these States are large importers of high-uality veneer logs.

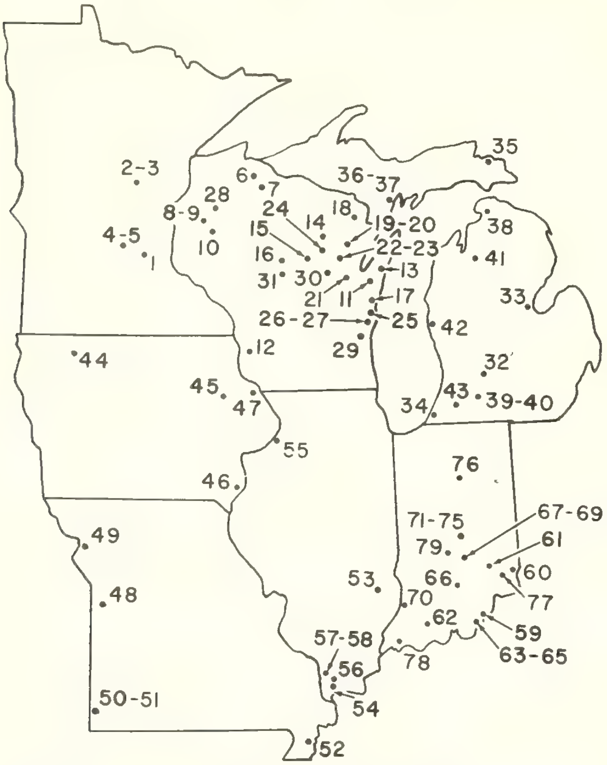
LAKE STATES

Production

Lake States loggers harvested 50.9 million board feet of veneer logs in 1966 (table 1), nearly one million board feet less than the previous year (after deducting 1966 overseas exports). Harvesting was up 1.6 million board feet from 1965 in Michigan but was more than offset by a lower cut in Minnesota and Wisconsin. Most of the logs, 45 million board feet, went to mills cutting commercial, utility, and face veneers for doors, furniture, wall panels, specialty plywoods, and similar items. The remainder was used in manufacturing veneer for boxes, baskets, and other containers. An additional 2,500 cords of small logs were cut for heading stock for container mills.

Hard maple increased its lead as the dominant species cut in the Lake States. Slightly more than 13 million board feet were cut in 1966 — an increase of 1.3 million over the previous year. Hard maple shipments from the Lake States, primarily to Indiana veneer mills, were up 46 percent from 1965.

FIGURE 1. — Location of active veneer mills in the the North Central States, 1966



NUMBER	MILL AND LOCATION
	Minnesota
1	Bren Berry Box Mfg. Co., Hopkins
2	Mille Lacs Corp., Isle
3	Wahkon Veneer Mills, Wahkon
4	Buffalo Veneer & Plywood Co., Buffalo
5	Elk River Box Co., Elk River
	Wisconsin
6	Calumet & Hecla Inc., Mellen
7	Northern Hardwood Veneer Inc., Butternut
8	Birchwood Mfg. Co., Rice Lake
9	Brunette Box & Veneer Co., Rice Lake
10	Ebner Box Factory, Cameron
11	Dufeck Mfg. Co., Denmark
12	Wauzeka Box Co., Wauzeka
13	U.S. Plywood Corp., Algoma
14	General Plywood Corp., Antigo
15	Hatley Veneer Co., Inc., Hatley
16	Standard Container Co., Edgar
17	Eggers Plywood Co., Two Rivers
18	Calumet & Hecla Inc., Goodman
19	Gillette Veneer & Plywood Co., Gillett
20	Linwood Inc., Gillett
21	Seymour Woodenware Co., Seymour
22	H. Iwen Box & Veneer Co., Shawano
23	Weber Veneer & Plywood Co., Shawano
24	Wisconsin Timber & Land Co., Mattoon
25	Konz Container Co., Howard Grove
26	Larson Plywood Co. Inc., Sheboygan
27	Millersville Box Co., Sheboygan
28	Birchwood Lumber & Veneer Co., Birchwood
29	Cooley Mfg. Co., West Bend
30	Marion Plywood Corp., Marion
31	Weyerhaeuser Co., Marshfield
	Michigan
32	Plycoma Veneer Co., Nashville
33	Dyjack Wood Products, Kawkawlin
34	Anderson Container Corp., Stevensville
35	Soo Veneer Co., Sault Ste. Marie
36	Anthony & Co., Escanaba
37	Birdseye Veneer & Plywood Co., Escanaba
38	Manthei Bros., Petoskey
39	A. C. Hensel Mfg. Co., Augusta
40	Augusta Basket Co., Augusta
41	American Made Veneer, Kalkaska
42	Walkinshaw Package Co., Shelby
43	Fruit Growers Package Co., Paw Paw
	Iowa
44	Spencer Hardwood Lumber Co., Spencer
45	Manchester Industries Inc., Manchester
46	Burlington Basket Co., Burlington
47	R. S. Bacon Veneer Co., Dubuque
	Missouri
48	Enterprise Veneer Corp., Pleasant Hill
49	Missouri Valley Walnut Co., St. Joseph
50	Crumbliss Wood Products, Neosho
51	Neosho Box & Wood Products, Neosho
52	Betz Tipton Veneer Co., Caruthersville
	Illinois
53	Newton Box & Basket Co., Newton
54	Main Brothers Box & Lbr. Co., Karnak
55	Swords Veneer & Lumber Co., Rock Island
56	Dongola Veneer Co. Inc., Dongola
57	Lawrence Box & Basket Co., Cobden
58	Cobden Box & Basket Co., Cobden
	Indiana
59	Roberts & Strack Veneer Co., Clarksville
60	Pierson-Holowell Co. Inc., Lawrenceburg
61	Mitchell Industries, Greensburg
62	Jasper Veneer Mills, Jasper
63	B. L. Curry & Sons, New Albany
64	Chester B. Stem Inc., New Albany
65	New Albany Box & Basket Co., New Albany
66	National Veneer & Lumber Co., Seymour
67	Amos-Thompson Corp., Edinburg
68	David R. Webb Co., Edinburg
69	Hill Brothers Veneer Co Inc., Edinburg
70	Farrel Box Co. Inc., Decker
71	Central Veneer Inc., Indianapolis
72	Curry Miller Veneers Inc., Indianapolis
73	Hoosier Veneer Co. Inc., Indianapolis
74	Indiana Veneers Inc., Indianapolis
75	Theising Veneer Co., Indianapolis
76	W. C. Redmon Sons Inc., Peru
77	Thompson Veneer Co., Milan
78	Evansville Veneer Co., Evansville
79	Theising Veneer Co. Inc., Mooresville

Table 1. — *Production and imports of veneer logs, Lake States, 1966*
(Thousand board feet, International ¼-inch rule)

Species and destination	Production[1]				Imports			Lake State consumption[3]
	Minnesota	Wisconsin	Michigan	Region total	Other States	Canada	Total imports	
Aspen								
Minn.	3	-	-	3	-	-	-	3
Wis.	8	358	118	484	-	-	-	484
Mich.	-	-	214	214	-	-	-	214
Total	11	358	332	701	-	-	-	701
Ash								
Minn.	13	-	-	13	-	-	-	13
Wis.	108	594	45	747	75	-	75	822
Mich.	-	-	259	259	55	-	55	314
Outside L.S.[2]	-	-	32	32	-	-	-	-
Total	121	594	336	1,051	130	-	130	1,149
Basswood								
Minn.	135	-	-	135	-	-	-	135
Wis.	1,306	2,010	214	3,530	245	-	245	3,775
Mich.	-	62	775	837	-	35	35	872
Outside L.S.	-	-	23	23	-	-	-	-
Total	1,441	2,072	1,012	4,525	245	35	280	4,782
Beech								
Wis.	-	65	84	149	-	-	-	149
Mich.	-	-	333	333	-	-	-	333
Total	-	65	417	482	-	-	-	482
Birch								
Minn.	143	-	-	143	-	-	-	143
Wis.	788	2,009	3,217	6,014	-	4,151	4,151	10,165
Mich.	138	91	3,034	3,263	-	1,107	1,107	4,370
Outside L.S.	-	-	83	83	-	-	-	-
Total	1,069	2,100	6,334	9,503	-	5,258	5,258	14,678
Cottonwood								
Minn.	82	-	-	82	-	-	-	82
Wis.	800	122	-	922	860	-	860	1,782
Mich.	-	-	443	443	-	-	-	443
Total	882	122	443	1,447	860	-	860	2,307
Elm								
Minn.	55	-	-	55	-	-	-	55
Wis.	1,267	2,920	-	4,187	256	-	256	4,443
Mich.	-	72	1,191	1,263	-	-	-	1,263
Outside L.S.	-	98	49	147	-	-	-	-
Total	1,322	3,090	1,240	5,652	256	-	256	5,761
Hard maple								
Wis.	328	3,783	3,323	7,434	178	1,357	1,535	8,969
Mich.	-	124	3,683	3,807	11	57	68	3,875
Outside L.S.	-	44	1,803	1,847	-	-	-	-
Total	328	3,951	8,809	13,088	189	1,414	1,603	12,844
Soft maple								
Minn.	80	-	-	80	-	-	-	80
Wis.	125	1,094	101	1,320	298	-	298	1,618
Mich.	-	-	69	69	-	-	-	69
Outside L.S.	-	35	-	35	-	-	-	-
Total	205	1,129	170	1,504	298	-	298	1,767
Red oak								
Wis.	453	7,066	1,051	8,570	646	82	728	9,298
Mich.	-	167	264	431	6	-	6	437
Outside L.S.	-	1	158	159	-	-	-	-
Total	453	7,234	1,473	9,160	652	82	734	9,735
White oak								
Wis.	9	169	6	184	4	-	4	188
Mich.	-	22	-	22	-	-	-	22
Outside L.S.	-	-	75	75	-	-	-	-
Total	9	191	81	281	4	-	4	210
Walnut								
Wis.	-	33	-	33	-	-	-	33
Mich.	-	-	4	4	6	-	6	10
Outside L.S.	123	732	596	1,451	-	-	-	-
Total	123	765	600	1,488	6	-	6	43
Misc. species								
Wis.	15	235	106	356	80	-	80	436
Mich.	-	47	385	432	128	-	128	560
Outside L.S.	99	914	204	1,217	-	-	-	-
Total	114	1,196	695	2,005	208	-	208	996
All species								
Minn.	511	-	-	511	-	-	-	511
Wis.	5,207	20,458	8,265	33,930	2,642	5,590	8,232	42,162
Mich.	138	585	10,654	11,377	206	1,199	1,405	12,782
Outside L.S.	222	1,824	3,023	5,069	-	-	-	-
Total	6,078	22,867	21,942	50,887	2,848	6,789	9,637	55,455

[1] Vertical columns of figures under box heading "Production" represents the quantity of Veneer logs cut in each State.

[2] Veneer logs shipped to mills outside the Lake States.

[3] Production minus exports plus imports.

Oak nearly bypassed birch as runner-up in production. The oak harvest rose 400 thousand board feet from 1965, while birch declined 1.8 million board feet. This reflects the continuing shift to a more plentiful species. The oak cut in 1966 was 3½ times greater than the cut 20 years earlier and twice that in 1958.

On the other hand, birch imports from Canada were 2 million board feet greater than in 1965. Apparently the demand for birch remained high, but local sources were unable to compete as effectively in 1966 with Canadian producers as in 1965.

To supply Indiana veneer mills, walnut cutting rose 600 thousand board feet in the Lake States from 1965. Most of this wood came from Wisconsin. Only 2 percent of the walnut harvest was processed in the Lake States.

Consumption

Veneer log imports to and exports from the Lake States were each more than 2 million board feet more than in 1965, but consumption of veneer logs at Lake States mills declined 1.2 million board feet to 55.4 million. Resident mills imported nearly twice the volume that was shipped from the area.

Consumption declined partly because two mills closed down and another switched from producing to buying veneer. No new mills began operating in 1966, but one or two may begin in 1968.

Wisconsin veneer mills received three-fourths of all veneer logs consumed in the Lake States. These mills depend upon Minnesota, Michigan and Canada for nearly half of their logs. Michigan mills obtained over four-fifths of their logs from within the State. Their greatest log import is yellow birch from Canada. The five mills in Minnesota used less than 10 percent of the veneer logs produced there without using any logs from other sources.

CENTRAL STATES

Veneer-log production in Indiana, Illinois, Missouri, and Iowa was 36.7 million board feet, down 3 percent from 1963 but slightly above the average for the last 10 years (table 2). Face and commercial veneer mills consumed 33.1 million board feet from the Central States; container veneer mills used the remainder.

Indiana mills used 55 percent of the cut; the other Central States mills used 30 percent. The rest was shipped to mills in Michigan, Kentucky, Virginia, Wisconsin, and Canada.

More walnut was cut for veneer in 1966 than any other species. Nearly 15 million board feet were taken from the woods — the second largest cut in the last 10 years. Cottonwood logging accounted for another 6.2 million board feet, the second highest species volume cut although the lowest harvest of cottonwood for 10 years. No other species cut was over 3 million board feet.

Twenty-four regional commercial and face veneer mills and 12 container mills used 48.2 million board feet of veneer logs, 8 percent less than in 1963. These mills imported 16.7 million board feet of which 13.7 million went to Indiana mills. Important sources of supply included Kentucky, Michigan, Ohio, Pennsylvania, and Wisconsin.

All but three of the 21 veneer mills in Indiana are primarily face and commercial veneer manufacturers. More than half of the Indiana mills high-quality logs come from other states. On the other hand, Iowa and Illinois are large net exporters of logs (table 3). They shipped more than 5 million board feet to Indiana's 20 mills. More than half was walnut. Iowa produces nearly twice as much veneer log volume as it consumes and Illinois one and one-half times as much.

Missouri log production and consumption are nearly equal: the State is a net exporter of more than one million board feet of high-quality veneer logs but this is offset by net imports of container veneer logs. Since 1963 Missouri and Iowa have each gained one new veneer mill.

Table 2. — *Production and imports of veneer logs, Central States, 1966*
(Thousand board feet, International ¼-inch rule)

Species and destination	Production					Imports			Central States consumption[3]
	Indiana	Illinois	Iowa	Missouri	Region total	Other States	Canada	Total imports	
Ash									
Indiana	310	12	-	-	322	237	-	237	559
Other C.S.[1]	-	-	2	153	155	99	-	99	254
Outside C.S.	71	1	75	-	147	-	-	-	-
Total	381	13	77	153	624	336	-	336	813
Basswood									
Indiana	2	-	-	-	2	23	-	23	25
Other C.S.	-	-	364	-	364	-	-	-	364
Outside C.S.	-	22	223	-	245	-	-	-	-
Total	2	22	587	-	611	23	-	23	389
Black cherry									
Indiana	129	4	-	1	134	1,204	-	1,204	1,338
Other C.S.	-	-	14	-	14	7	-	7	21
Outside C.S.	11	-	-	-	11	-	-	-	-
Total	140	4	14	1	159	1,211	-	1,211	1,359
Cottonwood									
Indiana	1,019	-	-	-	1,019	132	-	132	1,151
Other C.S.	110	2,131	-	2,111	4,352	1,150	-	1,150	5,502
Outside C.S.	-	-	849	11	860	-	-	-	-
Total	1,129	2,131	849	2,122	6,231	1,282	-	1,282	6,653
Gum									
Indiana	491	-	-	-	491	523	-	523	1,014
Other C.S.	11	107	-	57	175	31	-	31	206
Outside C.S.	-	26	-	1	27	-	-	-	-
Total	502	133	-	58	693	554	-	554	1,220
Hickory									
Indiana	726	163	-	142	1,031	511	-	511	1,542
Other C.S.	-	-	7	35	42	-	-	-	42
Outside C.S.	6	-	-	-	6	-	-	-	-
Total	732	163	7	177	1,079	511	-	511	1,584
Hard maple									
Indiana	1,027	-	-	1	1,028	2,132	212	2,344	3,372
Other C.S.	-	28	75	96	199	36	-	36	235
Outside C.S.	53	8	170	-	231	-	-	-	-
Total	1,080	36	245	97	1,458	2,168	212	2,380	3,607
Soft maple									
Indiana	36	-	-	-	36	50	-	50	86
Other C.S.	-	36	68	96	200	71	-	71	271
Outside C.S.	-	54	252	2	308	-	-	-	-
Total	36	90	320	98	544	121	-	121	357
Red oak									
Indiana	400	66	-	-	466	423	-	423	889
Other C.S.	-	660	344	96	1,100	52	-	52	1,152
Outside C.S.	29	142	523	-	694	-	-	-	-
Total	429	868	867	96	2,260	475	-	475	2,041
White oak									
Indiana	1,421	68	-	-	1,489	453	-	453	1,942
Other C.S.	-	-	26	96	122	36	-	36	158
Outside C.S.	260	3	4	4	271	-	-	-	-
Total	1,681	71	30	100	1,882	489	-	489	2,100
Sycamore									
Indiana	510	-	-	-	510	181	-	181	691
Other C.S.	55	169	-	222	446	73	-	73	519
Outside C.S.	-	33	47	1	81	-	-	-	-
Total	565	202	47	223	1,037	254	-	254	1,210
Yellow poplar									
Indiana	2,439	497	-	1	2,937	1,458	-	1,458	4,395
Other C.S.	-	11	-	-	11	-	-	-	11
Outside C.S.	30	13	-	-	43	-	-	-	-
Total	2,469	521	-	1	2,991	1,458	-	1,458	4,406
Walnut									
Indiana	5,366	1,813	1,690	626	9,495	4,094	-	4,094	13,589
Other C.S.	-	427	1,200	1,585	3,212	1,126	-	1,126	4,338
Outside C.S.	1,046	132	248	554	1,980	-	-	-	-
Total	6,412	2,372	3,138	2,765	14,687	5,220	-	5,220	17,927
Misc. species									
Indiana	204	827	209	59	1,299	1,922	164[2]	2,086	3,385
Other C.S.	-	70	241	535	846	337	-	337	1,183
Outside C.S.	1	4	279	44	328	-	-	-	-
Total	205	901	729	638	2,473	2,259	164	2,423	4,568
All species									
Indiana	14,080	3,450	1,899	830	20,259	13,343	376	13,719	33,978
Other C.S.	176	3,639	2,341	5,082	11,238	3,018	-	3,018	14,256
Outside C.S.	1,507	438	2,670	617	5,232	-	-	-	-
Total	15,763	7,527	6,910	6,529	36,729	16,361	376	16,737	48,234

[1] Illinois, Iowa, and Missouri.

[2] Imported from South America or Africa.

[3] Production minus exports plus imports.

Table 3. — *Veneer logs retained in state of origin, by species*
(In percent)

Species	State of origin			
	Indiana	Illinois	Iowa	Missouri
Ash	81	-	3	100
Basswood	100	-	62	-
Black cherry	92	-	100	-
Cottonwood	90	100	-	88
Gum	98	80	-	98
Hickory	99	-	100	-
Hard maple	95	78	31	99
Soft maple	100	40	21	98
Red oak	93	76	40	100
White oak	84	-	87	96
Sycamore	90	84	-	99
Yellow poplar	99	2	-	-
Walnut	84	12	21	27
Other	99	*	27	80
All species	89	46	25	60

* Less than 0.5 percent

In the last 10 years the use of hard maple has more than tripled in the Central States A shift in consumer tastes to Colonial, Early American, and Federal furniture designs which favor the use of maple, has probably been an important reason for the increase Fine furniture veneers are important products of Central States mills.

Another furniture wood increasing in popularity is pecan which is included under the hickory group. The use of hickory has more than doubled since 1956.

* * *

REPORTS ON VENEER-LOG PRODUCTION PUBLISHED BY NORTH CENTRAL FOREST EXPERIMENT STATION

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U.S.D.A. FOREST SERVICE
RESOURCE BULLETIN NC-6
1969

PULPWOOD PRODUCTION AND CONSUMPTION

in the

NORTH CENTRAL REGION BY COUNTY

1967

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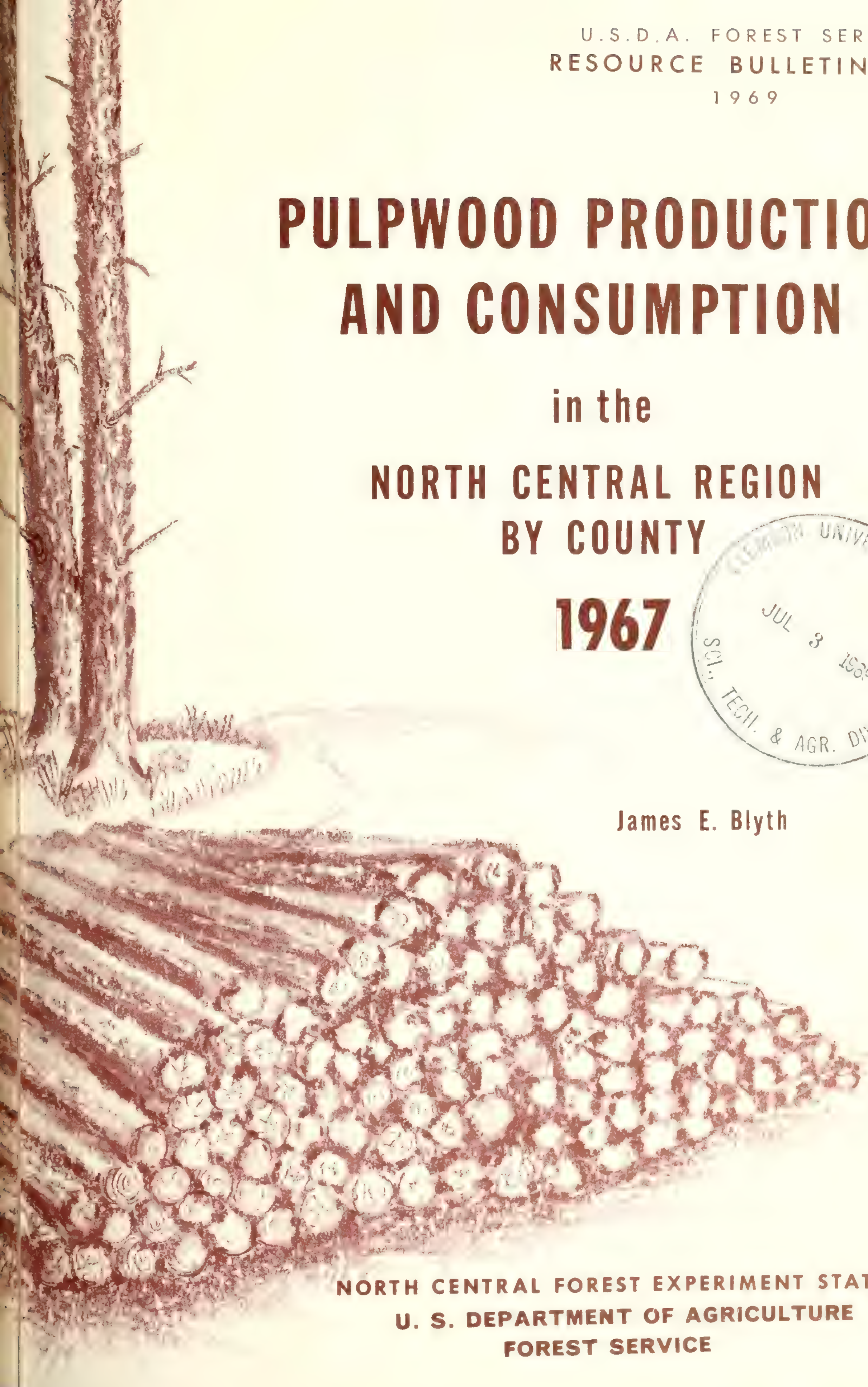

James E. Blyth

NORTH CENTRAL FOREST EXPERIMENT STATION
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

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NOTE: The author is a Market Analyst on the staff of the North Central Forest Experiment Station. He is headquartered at the Station's main office in St. Paul, Minn., which is maintained in cooperation with the University of Minnesota.

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Pulpwood Production and Consumption in the North Central Region, by County, 1967

James E. Blyth

This is the ninth annual report on the ulpwood harvest in Lake States Counties and he eighth annual report on the Central States arvest. The Lake States and Central States re discussed separately because the timber ypes in each area are different and less inormation can be released about the Central tates — more detailed data published on ulpwood production and consumption in the Central States would reveal the operations of individual mills.

The pulpmills using North Central States timber in 1967 reported their pulpwood receipts by state and county. Their cooperation is gratefully acknowledged. Thanks are due also to Ray Pfeifer, Forest Survey Coordinator, Michigan Department of Conservation, for collecting data on the Michigan pulpmills.

LAKE STATES

Pulpwood production[1] and consumption eclined from 1966, but were the second highst ever recorded. Partially responsible for he declines were the closing of several Lake tates pulpmills, high pulpwood inventories t Lake States mills in early 1967, a leveling ff of national paper and board inventories fter a large buildup in 1966, and a drop in ational per capita consumption of paper and oard from 536 pounds in 1966 to 512 pounds n 1967.

Production Drops 7 Percent

Pulpwood production was 3,965,000 cords n 1967, down 315,000 cords from 1966. Only 6,000 cords were shipped to mills outside he Lake States. Ninety-five percent of the otal production was roundwood; the balance was residue from local wood-using plants. The use of Lake States mill residue for pulping was up 40,000 cords from 1966; seven-tenths of this residue was delivered to pulpmills as chips.

Aspen constituted 53 percent of the roundwood harvest, although 222,000 cords less were cut than in 1966. Other reductions in cutting from the previous year included 152,000 cords of pine and 65,000 cords of hemlock. On the other hand, the spruce harvest increased by 42,000 cords and the tamarack harvest by 33,000.

Only 23 percent of the 1967 roundwood harvest was peeled before delivery, compared to 27 percent in 1966. More than 90 percent of the peeled wood was aspen. Wisconsin loggers peeled slightly more than half of their 1967 aspen pulpwood, whereas Michigan loggers peeled two-fifths, and Minnesota loggers about one-fourth (fig. 1). Peeled aspen was common in all districts of Wisconsin, but varied greatly as a percent of total cut by district in Minnesota and Michigan.

---

[1] *"Production" is "the harvest of pulpwood from imber lands in a specified area and received at nills during 1967," whereas "consumption" is "the olume of wood received by mills in a specified rea regardless of the geographic source."*

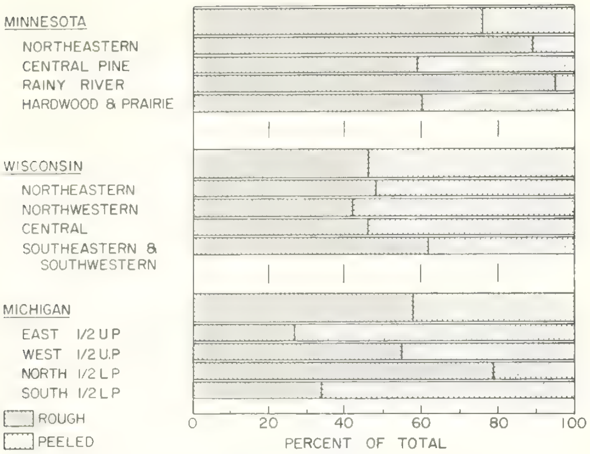

FIGURE 1. — Percent of rough and peeled aspen production of roundwood, by State and Forest Survey District, 1967.

Consumption Down More Than 300,0000 Cords

Forty-six Lake States mills processed nearly 4½ million cords of pulpwood in 1967, off 6 percent from 1966. Aspen, pine, and spruce accounted for 78 percent of all roundwood consumed. All but seven mills used aspen (table 1).

Table 1. — Number of plants using the different species of wood for pulping in 1967

Species and kind of material	Lake States	Minn.	Wis.	Mich.
Aspen	39	9	22	8
Balsam fir	20	5	11	4
Birch	12	2	8	2
Hemlock	6	-	5	1
Pine	12	3	5	4
Spruce	23	5	14	4
Tamarack	6	1	5	-
Misc. hardwoods	15	2	8	5
Wood chips	11	3	5	3
Slabwood and other residue	6	1	4	1
Total plants	46	9	27	10

Lake States pulpmills are using an increasing volume of mill residues, consuming 80,000 cords more in 1967 than in 1966. Nearly half of the increase was softwood residues from western states.

Total pulpwood imports increased slight to 531,000 cords (table 2). Major impor were 105,000 cords of pine roundwood ar 124,000 cords of softwood chips from wes ern states, and 214,000 cords of spruce roun wood from Canada.

Table 2. — Pulpwood exports and impor for the Lake States, 1967 (Thousand standard cords, unpeeled)

Species	Exports	Imports	Net exports c (imports)
Aspen	-	13	(13)
Balsam fir	*	20	(20)
Pine	-	143	(143)
Spruce	21	219	(198)
Mixed hardwoods	4	8	(4)
Residues, softwood	5	124	(119)
Residues, hardwood	6	4	2
Total	36	531	(495)

* Less than 500 cords

Wisconsin Mill Procurement Shifts Westward

Wisconsin mills bucked the regional tre l and used slightly more wood than in 196. They increased their purchases from Minn sota by 105,000 cords and from the weste states by 48,000 cords, but reduced their state purchases by 113,000 cords. The volu of wood obtained from Michigan remain l about the same as in 1966. For the first tim, Wisconsin procured more than 200,000 co s from western states, primarily pine rou wood and softwood chips. With few pulpmi s located in the Rocky Mountain area, logg s in that region have been eager to supply W consin mills.

Several Mills Close, Slightly Reducin Total Active Mill Capacity

Six pulpmills, with a collective daily pacity of 485 tons, closed during 1967 in t Lake States. However, because other mills panded, the net daily capacity loss was o y 185 tons. Also, some idled mills will be placed with more modern and higher capac y equipment. Thus, the decline in capacity s expected to be temporary. Total regio l capacity is still close to 10,000 tons per d y (table 3).

Table 3. — Active woodpulp mills in the Lake States, by location, type of pulp produced, and capacity, 1967

Company	Location	Mill capacity in tons per 24 hours[1/]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Minnesota:						
Blandin Paper Co.	Grand Rapids	205	--	--	205	--
Hennepin Paper Co.	Little Falls	65	--	--	65	--
Boise Cascade Corp.	International Falls.	755	180	125	450	--
Northwest Paper Co., The	Cloquet	420	115	305	--	--
Nu-Ply Corp.	Bemidji	75	--	--	75	--
St. Regis Paper Co.	Sartell	125	--	--	125	--
Superwood Corp.	Duluth	240	--	--	240	--
Hoerner Waldorf Corp.	St. Paul	275	--	--	--	275
Conwed Corp.	Cloquet	350	--	--	350	--
Total	9 plants	2,510	295	430	1,510	275
Wisconsin:						
American Can Co.	Green Bay	235	145	--	90	--
American Can Co.	Rothschild	180	180	--	--	--
Badger Paper Mills, Inc.	Peshtigo	90	90	--	--	--
Combined Paper Mills, Inc.	Combined Locks	175	--	--	175	--
Consolidated Papers, Inc.	Appleton	155	155	--	--	--
Consolidated Papers, Inc.	Stevens Point	100	--	--	100	--
Consolidated Papers, Inc.	Wisconsin Rapids	515	215	--	300	--
Green Bay Packaging, Inc.	Green Bay	250	--	--	--	250
Kansas City Star Co.	Park Falls	115	115	--	--	--
Kimberly-Clark Corp.	Kimberly	240	140	--	100	--
Kimberly-Clark Corp.	Niagara	150	--	--	150	--
Mosinee Paper Mills Co.	Mosinee	200	--	200	--	--
Nekoosa-Edwards Paper Co.	Nekoosa	310	--	310	--	--
Nekoosa-Edwards Paper Co.	Port Edwards	200	200	--	--	--
Owens-Illinois	Tomahawk	525	--	--	--	525
Procter & Gamble Co.	Green Bay	2/	2/	--	2/	--
Procter & Gamble Co.	Little Rapids	2/	--	--	2/	--
Scott Paper Co.	Marinette	50	50	--	--	--
Scott Paper Co.	Oconto Falls	110	110	--	--	--
St. Regis Paper Co.	Rhinelander	110	110	--	--	--
St. Regis Paper Co.	Cornell	50	--	--	50	--
Sterling Pulp & Paper Co.	Eau Claire	75	--	--	75	--
Superior Fiber Products Co.	Superior	180	--	--	180	--
Thilmany Pulp & Paper Co.	Kaukauna	360	--	360	--	--
Tomahawk Pulp Co., Inc.	Tomahawk	50	--	--	50	--
Wausau Paper Mills Co.	Brokaw	145	145	--	--	--
Wisconsin Wood Products, Inc.	Phillips	50	--	--	50	--
Total	27 plants	4,620	1,655	870	1,320	775
Michigan:						
Abitibi Corp.	Alpena	300	--	--	300	--
Celotex Corp.	L'Anse	270	--	--	270	--
Hoerner Waldorf Corp.	Ontonagon	250	--	--	--	250
Manistique Pulp & Paper Co.	Manistique	90	--	--	90	--
Mead Corp., The	Groos	100	--	--	100	--
Menasha Corp.	Otsego	225	--	--	--	225
Packaging Corp. of America	Filer City	565	--	165	--	400
Scott Paper Co.	Detroit	170	170	--	--	--
Scott Paper Co.	Menominee	20	--	--	20	--
Warren Co., S.D.	Muskegon	225	--	225	--	--
Total	10 plants	2,215	170	390	780	875
All States	46 plants	9,345	2,120	1,690	3,610	1,925

[1/] Lockwoods Directory of the Paper and Allied Industries-1968, and 1968 Directory of the Forest Products Industry.

[2/] Capacity not available.

Nationally Oriented Mill Ownership Increasing

Mergers and purchases of Lake States pulpmills by companies owning mills in other regions have been proceeding for several years. Some Lake States firms have also built plants in other regions. As a result, the management at many Lake States mills is more nationally oriented. National pulp and paper firms tend to consider larger geographic areas for expansion than regional firms, not only in the United States, but in Canada or overseas. They usually have greater product mixes than regional companies, and are more likely to merge or expand their operations beyond the wood-using field. They are also probably more likely to close marginal mills to seek larger rates of return on investment elsewhere. In other words, national organi ations base their decisions to build, expan or close Lake States mills upon additiona factors and a different outlook than regiona companies. Industrial development group forest owners, forest managers, and researc foresters can be more effective in attractin new pulpmills (and encouraging expansio of existing mills) if they recognize these di ferences.

Review of Pulpwood Production by States, 1967

Of the 1967 harvest, Wisconsin contrib uted 36 percent, Michigan 34 percent, an Minnesota 30 percent.

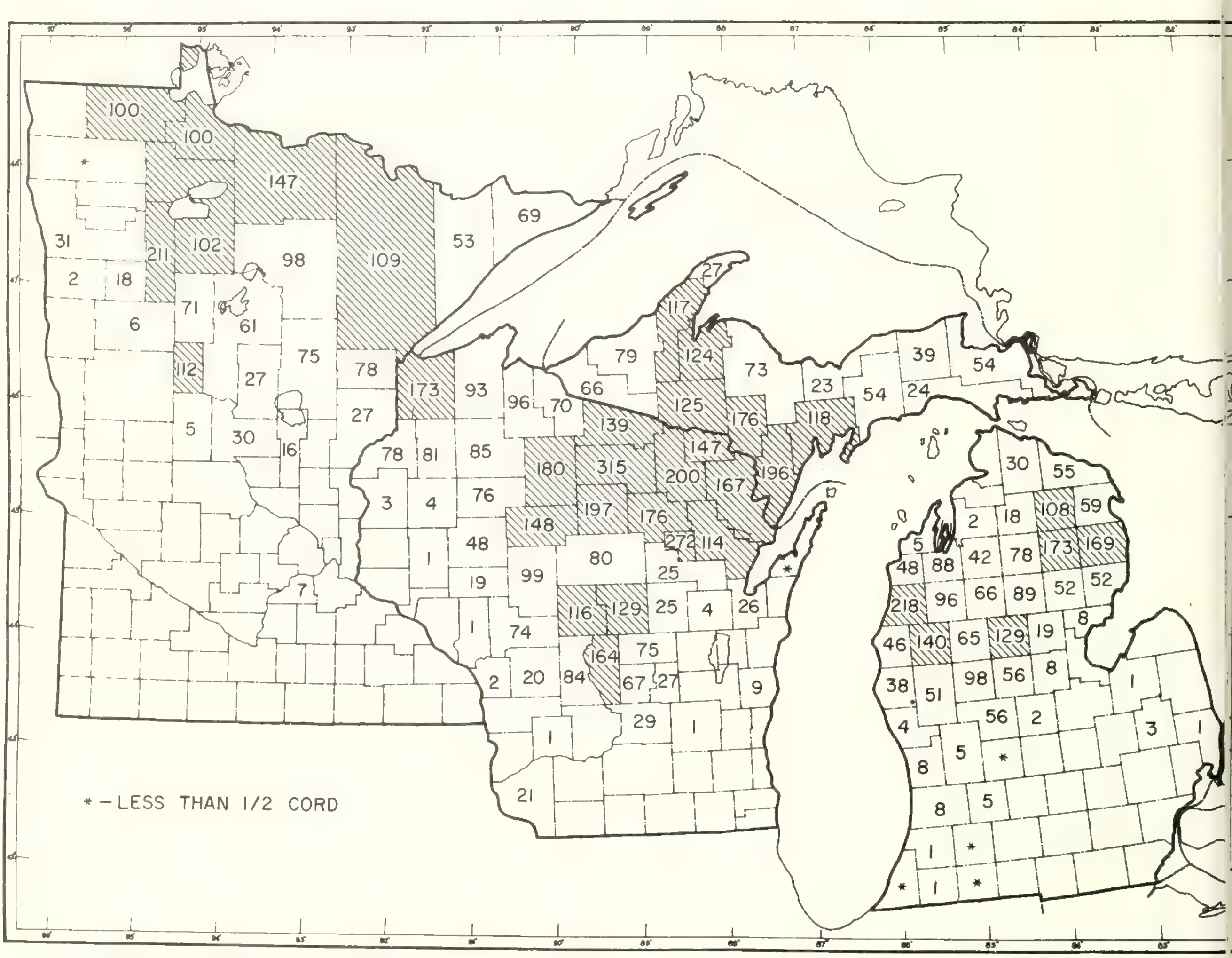

Figure 2. — Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1967. Crosshatching shows counties that supplied 100 or more cords of pulpwood per 1,000 acres of stocked commercial forest land.

The distribution of the pulpwood harvest is shown in two different ways: first, the amount of pulpwood cut relative to commercial forest area, and second, the amount of pulpwood cut relative to the merchantable volume in major pulpwood species. The pulpwood cut per 1,000 acres of stocked commercial forest land was greatest in central and northeast Wisconsin, western upper Michigan and scattered counties in northern Lower Michigan, and in northern Minnesota (fig. 2). The harvest per 1,000 cords of merchantable volume in principal pulpwood species was greatest in central Wisconsin and least in southern Wisconsin (fig. 3).

Wisconsin regains pulpwood harvest lead. — Although its production dropped 119,000 cords from 1966, Wisconsin took the lead in pulpwood cut, after 3 years in second place. Only 2 percent of the harvest was shipped out-of-state. All areas of the state shared in the decline, but the greatest volume drop was in the northeast. Top-producing counties were Oneida, Forest, and Marinette with 151,000, 101,000, and 90,000 cords, respectively.

Michigan cut dwindles by 226,000 cords. —Nearly all of the reduced pulpwood cutting in Michigan can be accounted for by lagging in-state consumption. Shipments to Wisconsin remained high and nearly equaled the cut volume remaining in Michigan. All areas of Michigan shared in the decline, but the major decrease was 137,000 cords in northern Lower Michigan. Menominee, Iron, and Marquette

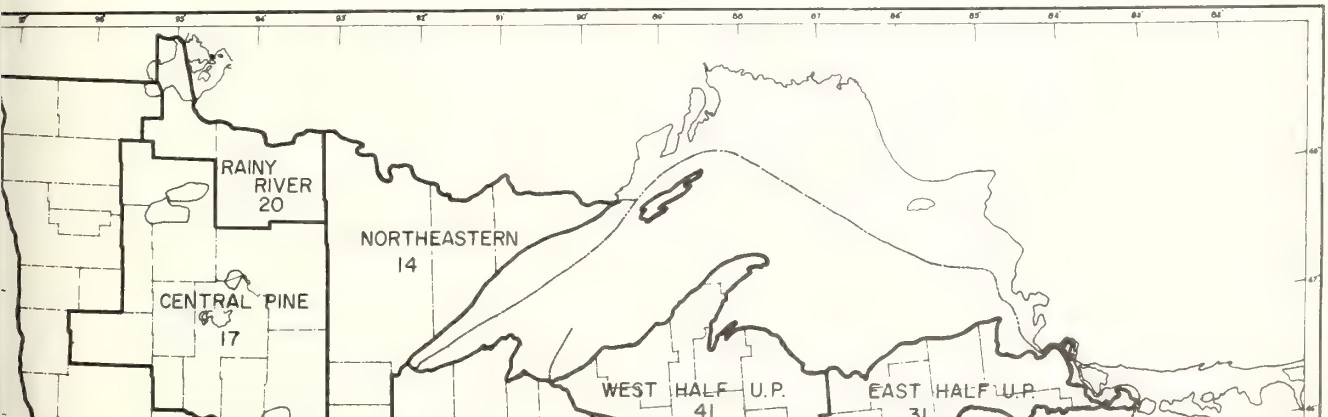

FIGURE 3. — Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species, by Forest Survey District, 1967. The heavy lines delineate the boundaries of the Forest Survey Districts in each state.

County loggers produced the largest pulpwood volume. All Upper Michigan counties and 46 in Lower Michigan contributed to the harvest.

Out-of-state customers boost Minnesota's harvest 3 percent. — Wisconsin and Canadian mills acquired enough additional Minnesota wood, compared to 1966, to more than offset reduced demands by Minnesota mills. Cutting of tamarack, normally a little-used specie jumped 33,000 cords in a year, and nearly a of it went to Wisconsin. For the first tim since 1961, less than three-fourths of the ha vest went to resident mills. Pulpwood cuttin rose modestly in all districts of Minnesot The Northeastern and Central Pine Unit provided three-fourths of the total cut. S Louis, Koochiching and Itasca Counties agai led production with 315,000, 205,000, an 128,000 cords, respectively.

CENTRAL STATES

Central States pulpwood production was 53,000 cords in 1967, a decline of 8 percent (see Appendix table 10). Only 7,500 cords, cut primarily in Indiana, were shipped to mills outside the Central States.

Fourteen Central States pulpmills proessed 288,000 cords of pulpwood in 1967, a drop of 4 percent from 1966. Major reasons or the drop in pulpwood consumption, as in he Lake States, were a leveling off in nationl paper and board inventories and a declinng per capita consumption of these commodiies in 1967.

Roundwood Harvest Lowest Since 1959

Central States forests yielded 186,000 ords of pulpwood in 1967, 52,000 less than n 1966. Illinois and Indiana accounted for he decline, as shown in the 5-year summary below:

In thousand cords

State	*1963*	*1964*	*1965*	*1966*	*1967*
llinois	102	105	77	97	69
ndiana	79	85	82	94	69
Iowa	20	33	25	27	27
Missouri	21	23	20	19	21
Total	222	246	204	237	186

During the last 5 years, pulpwood cutting has emained more constant in Iowa and Missouri han in Illinois and Indiana. Less than 2 percent of the harvest was shipped to mills outide the region.

All species groups contributed to the decline; soft hardwood cutting was off 27,000 cords, hard hardwoods 17,000 cords, and softwoods 8,000 cords.[2] Nearly all of the softwood cut came from Illinois. Each Central State cut 0,000 cords or more of soft hardwoods, with llinois producing the largest volume. Indiana was the leading producer of hard hardwoods.

No counties cut over 11,000 cords of pulpwood in 1967 (fig. 4). Counties producing over 4,000 cords included Sullivan, Gibson, Ripley, and Jennings in Indiana; Wabash, Massac, Lawrence, and Pulaski in Illinois; and Dubuque and Lee in Iowa. Of 112 pulpwood-producing counties, 43 were in Illinois, 38 in Indiana, 16 in Missouri, and 15 in Iowa.

Consumption Shifting from Roundwood to Residues

Eighty-seven thousand cords of slabs, edgings, veneer cores, sawdust, and wood flour were used for pulping at Central States pulpmills in 1967. Fifty thousand cords of residue were used in Illinois — double the volume used in 1966. Residue consumed in other Central States increased 12,000 cords from 1966. Chips constituted 89 percent of the total residue used compared to only 70 percent a year earlier.

Roundwood receipts fell 46,000 cords from 1966, to the lowest level in the last 5 years (table 4). The net result was a decline in consumption of 13,000 cords in 1967.

The trend for several years has been toward increasing use of residue as a replacement for roundwood. In 1962, regional mills used only 20,000 cords of residue, 7 percent of their total wood consumption. Since then,

Table 4. — Trends in consumption of roundwood and residues as pulpwood, Central States, 1963-1967

Type of material and area	1963	1964	1965	1966	1967
Roundwood					
Illinois	91	82	68	84	63
Indiana, Iowa, Missouri	142	163	143	163	138
Total	233	245	211	247	201
Residue					
Illinois	17	25	22	25	50
Indiana, Iowa, Missouri	12	14	24	29	37
Total	29	39	46	54	87
All material	262	284	257	301	288

---

[2] *Soft hardwoods include species such as elm, basswood, soft maple, yellow-poplar, and cottonwood. Hard hardwoods include oak, hard maple, beech, and hickory.*

residue receipts at these mills have increased every year, and in 1967 accounted for 30 percent of their total pulpwood consumption (table 4). The increasing use of wood residues in pulping is expected to continue although the percentage used in relation to roundwood may be approaching an upper limit.

Thirty percent of the residue consumed in the region come from sawmills, cooperage mills, veneer mills and other wood-using plants in Wisconsin, Arkansas, Kentucky, Alabama, Mississippi, Louisiana, and Texas. Illinois supplied over half of the residue used for pulping in the Central States.

Active Pulpmill Capacity 1,500 Tons Per Day

Fourteen active pulpmills in the region have a collective pulping capacity of 1,525 tons per day, of which Illinois mills contribute more than half (table 5). Three-fifth of the capacity is for producing semichemica pulp, and the remainder for groundwood an other mechanical types. Pulping capacity increased by only 40 net tons in 1967, and n large expansions have been announced recently.

Large Kentucky Pulpmill May Need Central States Wood

A large Kentucky pulpmill is expected t begin operating in 1970, eventually using a estimated 1,000 cords of pine and hardwoo per day. The mill, located adjacent to Missouri and Illinois, may provide an additiona pulpwood outlet for loggers in these states Most nearby Missouri counties are not supplying any roundwood pulpwood now.

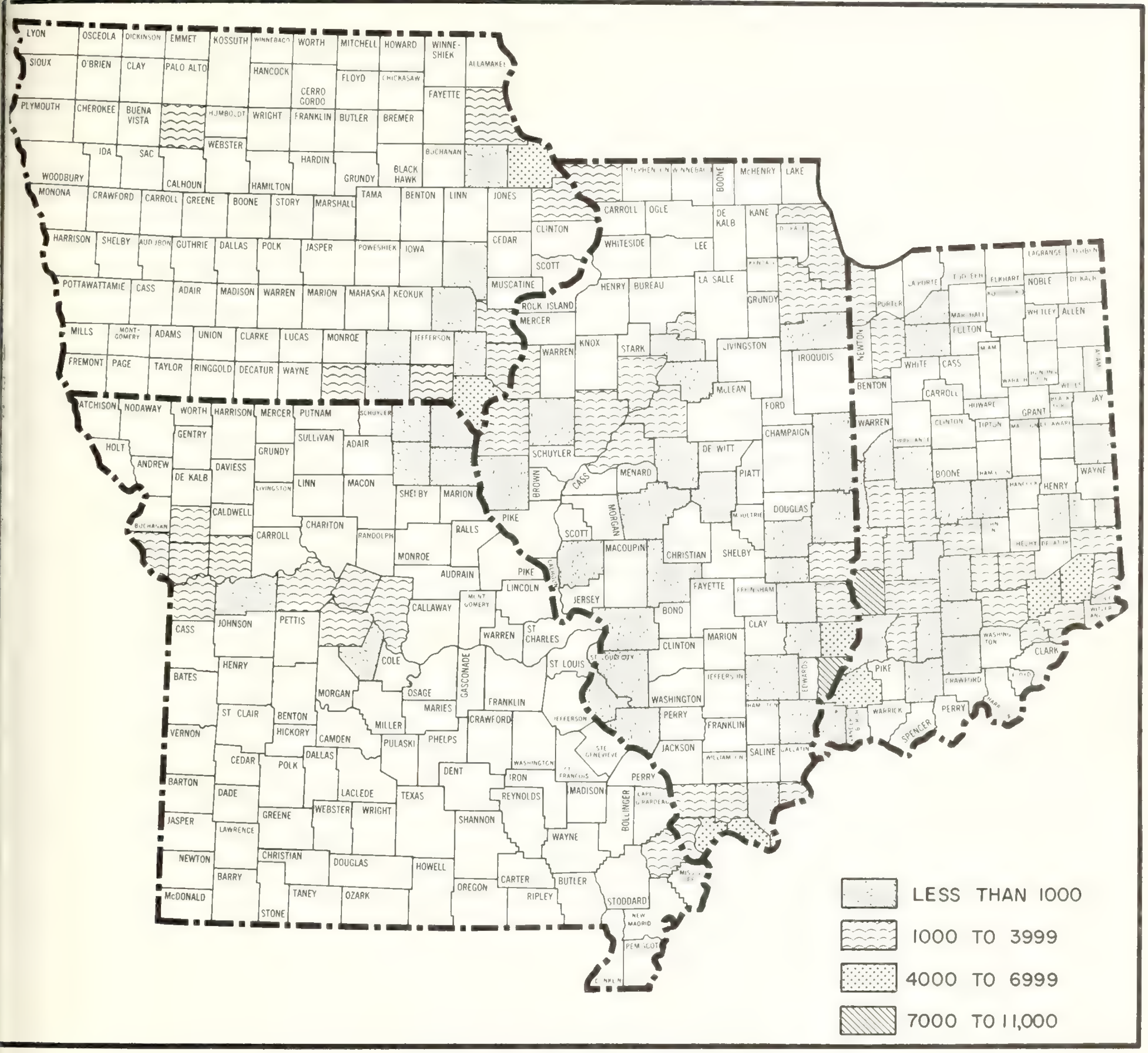

FIGURE 4. — Harvest of pulpwood bolts by counties, 1967

Table 5. — Active woodpulp mills in the Central States by location, type of pulp produced, and capacity, 1967

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Illinois:						
Celotex Corp	Peoria	190	--	--	190	--
Alton Box Board Co	Alton	300	--	--	--	300
Bird & Son, Inc	Chicago	40	--	--	40	--
Certain-Teed Products Corp	East St. Louis	100	--	--	100	--
Flintkote Co., The	Mt. Carmel	40	--	--	40	--
Johns-Manville Products Corp	Waukegan	65	--	--	65	--
General Aniline & Film Corp	Joliet	95	--	--	95	--
Total	7 plants	830	--	--	530	300
Indiana:						
Container Corp. of America	Carthage	120	--	--	--	120
Weston Paper & Manufacturing Co.	Terre Haute	250	--	--	--	250
Total	2 plants	370	--	--	--	370
Iowa:						
Celotex Corp	Dubuque	90	--	--	--	90
Consolidated Packaging Corp	Fort Madison	135	--	--	--	135
United States Gypsum Co	Fort Dodge	[2]	--	--	--	--
Total	3 plants	225	--	--	--	225
Missouri:						
Huebert Fiberboard, Inc	Booneville	60	--	--	60	--
General Aniline & Film Corp	Kansas City	40	--	--	40	--
Total	2 plants	100	--	--	100	--
All States	14 plants	1,525	--	--	630	895

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[1] Lockwoods Directory of the Paper and Allied Industries-1968, and 1968 Directory of the Forest Products Industry.

[2] Capacity not available.

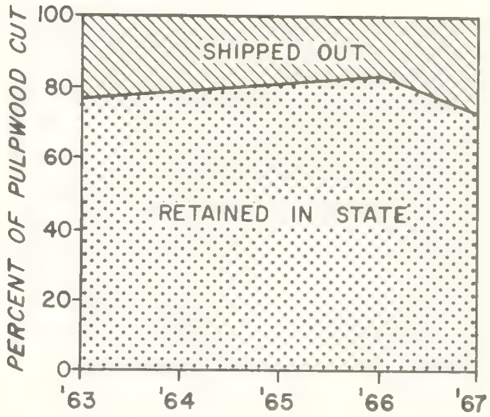
APPENDIX

Table 6 — Lake States pulpwood production, by State of origin and destination, 1963-1967

MINNESOTA

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1963	1,063	828	221	-	14
1964	1,062	856	193	-	13
1965	1,018	842	159	-	17
1966	1,174	970	193	*	11
1967	1,205	884	299	*	22
5-year average	1,104	876	213	*	15

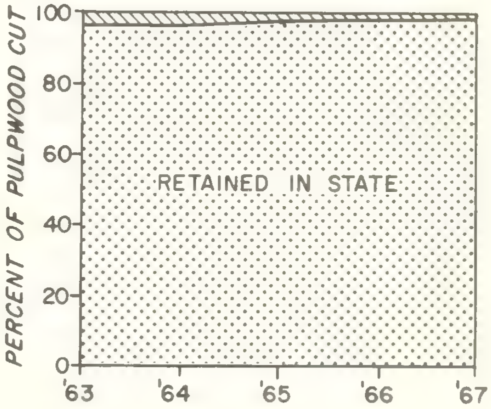
* Less than 500 cords.



WISCONSIN

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1963	1,302	20	1,262	2	18
1964	1,244	19	1,207	2	16
1965	1,253	8	1,225	1	19
1966	1,536	13	1,501	3	19
1967	1,416	15	1,387	*	14
5-year average	1,350	15	1,316	2	17

* Less than 500 cords.



MICHIGAN

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1963	1,297	-	633	664	-
1964	1,321	-	588	730	3
1965	1,365	-	608	750	7
1966	1,570	1	666	901	2
1967	1,344	-	660	684	*
5-year average	1,379	*	631	746	2

* Less than 500 cords.

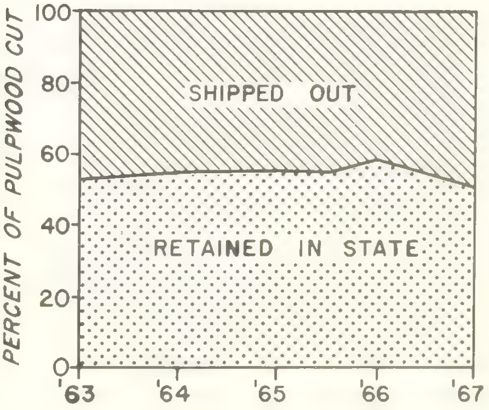


Table 7. — Lake States pulpwood production, by Forest Survey District and destination by State, 1967
(Thousand standard cords, roughwood basis)

MINNESOTA

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	459	306	152	*	1
Central Pine	453	341	112	-	-
Rainy River	249	203	25	-	21
Hardwood & Prairie	44	34	10	-	-
Total	1,205	884	299	*	22

WISCONSIN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	673	-	673	*	*
Northwestern	502	1	501	-	-
Central	207	4	200	-	3
Southeastern & Southwestern	34	10	13	-	11
Total	1,416	15	1,387	*	14

MICHIGAN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
E. ½ Up. Pen.	295	-	241	54	*
W. ½ Up. Pen.	508	-	419	89	-
N. ½ Low. Pen.	507	-	-	507	-
S. ½ Low. Pen.	34	-	-	34	*
Total	1,344	-	660	684	*

* Less than 500 cords.

Table 8. — Lake States pulpwood production by species, State, and Forest Survey District, 1963-1967

(Thousand standard cords, roughwood basis)

ASPEN					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	181	176	177	205	205
Central Pine	150	172	186	272	265
Rainy River	94	91	96	123	108
Prairie & Hardwood	8	12	9	12	13
Total	433	451	468	612	591
WISCONSIN					
Northeastern	321	332	341	449	430
Northwestern	219	208	220	298	273
Central	71	61	45	61	35
Southeastern & Southwestern	2	2	2	2	1
Total	613	603	608	810	739
MICHIGAN					
E. ½ Up. Pen.	122	112	142	156	144
W. ½ Up. Pen.	203	206	207	222	237
N. ½ Low. Pen.	314	332	341	388	258
S. ½ Low. Pen.	23	25	14	10	7
Total	662	675	704	776	646
LAKE STATES	1,708	1,729	1,780	2,198	1,976

BALSAM FIR					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	31	26	22	20	26
Central Pine	38	32	23	35	30
Rainy River	33	31	28	25	20
Prairie & Hardwood	*	*	*	-	-
Total	102	89	73	80	76
WISCONSIN					
Northeastern	33	27	25	28	26
Northwestern	27	29	24	26	21
Central	1	1	1	1	*
Southeastern & Southwestern	*	*	-	-	*
Total	61	57	50	55	47
MICHIGAN					
E. ½ Up. Pen.	63	47	41	48	50
W. ½ Up. Pen.	50	33	30	37	38
N. ½ Low. Pen.	8	4	2	3	3
S. ½ Low. Pen.	-	-	-	-	-
Total	121	84	73	88	91
LAKE STATES	284	230	196	223	214

* Less than 500 cords.

(Continued on next page)

(Table 8 continued)

(Thousand standard cords, roughwood basis)

JACK PINE[1]					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	136	129	101	138	108
Central Pine	50	49	56	85	69
Rainy River	14	17	12	15	11
Prairie & Hardwood	8	9	12	18	14
Total	208	204	181	256	202
WISCONSIN					
Northeastern	45	48	57	58	45
Northwestern	53	51	76	92	61
Central	69	68	72	64	67
Southeastern & Southwestern	3	1	1	1	1
Total	170	168	206	215	174
MICHIGAN					
E. ½ Up. Pen.	54	51	66	63	40
W. ½ Up. Pen.	36	40	47	47	36
N. ½ Low. Pen.	84	106	110	138	115
S. ½ Low. Pen.	*	1	1	2	2
Total	174	198	224	250	193
LAKE STATES	552	570	611	721	569

SPRUCE					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	125	118	106	78	93
Central Pine	39	50	38	31	45
Rainy River	90	88	92	61	79
Prairie & Hardwood	1	1	2	2	1
Total	255	257	238	172	218
WISCONSIN					
Northeastern	14	13	10	14	10
Northwestern	5	6	5	4	3
Central	*	*	*	*	*
Southeastern & Southwestern	*	*	-	-	-
Total	19	19	15	18	13
MICHIGAN					
E. ½ Up. Pen.	37	33	28	31	33
W. ½ Up. Pen.	46	35	36	42	40
N. ½ Low. Pen.	5	3	1	1	2
S. ½ Low. Pen.	-	-	-	-	-
Total	88	71	65	74	75
LAKE STATES	362	347	318	264	306

* Less than 500 cords.

[1] Includes small quantity of red and white pine.

(Continued on next page)

(Table 8 continued)

(Thousand standard cords, roughwood basis)

BIRCH[1]						HEMLOCK					
State and district	Annual production					State and district	Annual production				
	1963	1964	1965	1966	1967		1963	1964	1965	1966	1967
MINNESOTA						MINNESOTA					
Northeastern	*	-	-	-	1	Northeastern	-	-	-	-	-
Central Pine	*	*	*	1	2	Central Pine	-	-	-	-	-
Rainy River	*	-	-	-	-	Rainy River	-	-	-	-	-
Prairie & Hardwood	*	-	-	-	-	Prairie & Hardwood	-	-	-	-	-
Total	*	*	*	1	3	Total	-	-	-	-	-
WISCONSIN						WISCONSIN					
Northeastern	8	8	5	9	28	Northeastern	25	27	37	48	27
Northwestern	36	28	17	26	46	Northwestern	24	22	21	18	13
Central	6	5	2	4	10	Central	3	3	2	3	2
Southeastern & Southwestern	*	*	*	-	*	Southeastern & Southwestern	*	-	-	-	-
Total	50	41	24	39	84	Total	52	52	60	69	42
MICHIGAN						MICHIGAN					
E. ½ Up. Pen.	11	14	5	3	3	E. ½ Up. Pen.	6	10	9	21	16
W. ½ Up. Pen	4	6	1	2	2	W. ½ Up. Pen.	56	49	55	78	44
N. ½ Low. Pen.	8	18	26	8	6	N. ½ Low. Pen.	-	-	-	-	-
S. ½ Low. Pen.	-	-	-	-	-	S. ½ Low. Pen.	*	-	-	-	-
Total	23	38	32	13	11	Total	62	59	64	99	60
LAKE STATES	73	79	56	53	55	LAKE STATES	114	111	124	168	102

* Less than 500 cords.

[1] Includes 43,000 cords of Wisconsin birch reported as miscellaneous hardwoods in Research Note NC-59.

(Continued on next page)

(Table 8 continued)

(Thousand standard cords, roughwood basis)

TAMARACK					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	9	7	5	1	6
Central Pine	4	5	6	6	27
Rainy River	-	-	-	*	4
Prairie & Hardwood	*	*	1	*	3
Total	13	12	12	7	40
WISCONSIN					
Northeastern	1	1	1	1	2
Northwestern	5	3	3	2	1
Central	*	*	-	*	-
Southeastern & Southwestern	*	-	*	-	-
Total	6	4	4	3	3
MICHIGAN					
E. ½ Up. Pen.	1	2	2	1	1
W. ½ Up. Pen.	2	1	1	*	*
N. ½ Low. Pen.	-	-	*	-	-
S. ½ Low. Pen.	-	-	-	-	-
Total	3	3	3	1	1
LAKE STATES	22	19	19	11	44

MISC. HARDWOODS[1/]					
State and district	Annual production				
	1963	1964	1965	1966	1967
MINNESOTA					
Northeastern	4	3	4	4	9
Central Pine	35	29	24	13	6
Rainy River	9	9	10	13	23
Prairie & Hardwood	3	3	3	1	1
Total	51	44	41	31	39
WISCONSIN					
Northeastern	50	44	56	80	64
Northwestern	100	93	56	70	62
Central	74	75	77	84	71
Southeastern & Southwestern	9	12	9	8	6
Total	233	224	198	242	203
MICHIGAN					
E. ½ Up. Pen.	2	7	8	16	6
W. ½ Up. Pen.	54	60	63	70	79
N. ½ Low. Pen.	70	76	75	103	112
S. ½ Low. Pen.	5	3	3	5	2
Total	131	146	149	194	199
LAKE STATES	415	414	388	467	484

[1/] Excludes 43,000 cords of Wisconsin birch reported as miscellaneous hardwoods in Research Note NC-59.

* Less than 500 cords.

(Continued on next page)

(Table 8 continued)

(Thousand standard cords, roughwood basis)

RESIDUE & CHIPS[1]						ALL SPECIES[2]					
State and district	Annual production					State and district	Annual production				
	1963	1964	1965	1966	1967		1963	1964	1965	1966	1967
MINNESOTA						MINNESOTA					
Northeastern	-	-	1	3	11	Northeastern	486	459	416	449	459
Central Pine	-	2	2	6	9	Central Pine	316	339	335	449	453
Rainy River	-	-	-	-	4	Rainy River	240	236	238	237	249
Prairie & Hardwood	1	3	2	6	12	Prairie & Hardwood	21	28	29	39	44
Total	1	5	5	15	36	Total	1,063	1,062	1,018	1,174	1,205
WISCONSIN						WISCONSIN					
Northeastern	55	43	51	49	41	Northeastern	552	543	583	736	673
Northwestern	19	15	8	7	22	Northwestern	488	455	430	543	502
Central	19	12	6	5	22	Central	243	225	205	222	207
Southeastern & Southwestern	5	6	23	24	26	Southeastern & Southwestern	19	21	35	35	34
Total	98	76	88	85	111	Total	1,302	1,244	1,253	1,536	1,416
MICHIGAN						MICHIGAN					
E. ½ Up. Pen.	8	6	5	11	2	E. ½ Up. Pen.	304	282	306	350	295
W. ½ Up. Pen.	25	38	26	23	32	W. ½ Up. Pen.	476	468	466	521	508
N. ½ Low. Pen.	-	-	-	3	11	N. ½ Low. Pen.	489	539	555	644	507
S. ½ Low. Pen.	-	3	20	38	23	S. ½ Low. Pen.	28	32	38	55	34
Total	33	47	51	75	68	Total	1,297	1,321	1,365	1,570	1,344
LAKE STATES	132	128	144	175	215	LAKE STATES	3,662	3,627	3,636	4,280	3,965

[1] Not reported by district. Prorated on basis of most recent lumber output figures and location at shipping points.

[2] Including residues and chips.

* Less than 500 cords.

Table 9. — Lake States pulpwood production by county and species, 1967

(Thousand standard cords, roughwood basis)

District & county[1]	All species	Aspen	Balsam	Birch[2]	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residue & chips[3]
WISCONSIN										
NORTHEASTERN:										
Florence	36	31	1	*	2	1	1	-	*	
Forest	101	71	7	4	8	1	1	*	9	
Langlade	60	39	1	4	1	*	*	*	15	
Lincoln	64	43	2	3	2	1	1	*	12	
Marinette	90	64	4	3	2	10	2	1	4	
Menominee	31	22	*	-	8	1	*	-	*	
Oconto	36	30	1	1	*	2	1	-	1	
Oneida	151	98	6	8	1	18	3	1	16	
Shawano	7	5	*	*	1	*	*	-	1	
Vilas	56	27	4	5	2	11	1	*	6	
Total	673	430	26	23	27	45	10	2	64	41
NORTHWESTERN:										
Ashland	46	27	7	3	2	2	1	*	4	
Barron	*	*	-	*	-	-	-	-	*	
Bayfield	68	45	2	8	1	10	*	*	2	
Burnett	22	5	-	1	-	14	*	*	2	
Douglas	88	65	*	2	-	17	1	*	3	
Iron	26	15	3	2	1	*	1	-	4	
Polk	1	1	-	-	-	*	-	-	-	
Price	86	45	5	13	3	2	*	1	17	
Rusk	23	11	*	3	*	-	*	*	9	
Sawyer	49	24	2	9	3	3	*	*	8	
Taylor	44	22	2	5	3	-	*	*	12	
Washburn	27	13	*	*	*	13	*	*	1	
Total	502	273	21	46	13	61	3	1	62	22
CENTRAL:										
Adams	32	1	-	*	-	14	-	-	17	
Chippewa	10	9	*	-	*	1	-	-	*	
Clark	25	7	*	3	*	3	-	-	12	
Eau Claire	3	2	-	-	-	1	-	-	-	
Jackson	22	1	-	-	-	19	-	-	2	
Juneau	19	2	-	-	-	11	-	-	6	
Marathon	23	6	*	5	1	1	*	-	10	
Marquette	5	-	-	-	-	1	-	-	4	
Monroe	4	*	-	-	-	3	-	-	1	
Portage	15	2	*	1	1	5	*	-	6	
Waupaca	3	2	*	*	-	*	*	-	1	
Waushara	7	*	-	-	-	3	*	-	4	
Wood	17	3	-	1	*	5	*	-	8	
Total	207	35	*	10	2	67	*	-	71	22

(Continued on next page)

(Table 9 continued)

WISCONSIN (continued)

(Thousand standard cords, roughwood basis)

District & county[1]	All species	Aspen	Balsam	Birch[2]	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residue & chips[3]
SOUTHWESTERN:										
Dunn	*	*	-	-	-	*	-	-	-	
Grant	4	-	-	-	-	-	-	-	4	
La Crosse	*	-	-	-	-	*	-	-	-	
Richland	*	-	-	-	-	*	-	-	-	
Trempealeau	*	*	-	-	-	-	-	-	-	
Total	22	*	-	-	-	*	-	-	4	18
SOUTHEASTERN:										
Brown	1	1	*	*	-	*	-	-	*	
Columbia	2	*	-	*	-	1	-	-	1	
Dodge	*	-	-	-	-	-	-	-	*	
Door	*	-	-	-	-	-	-	-	*	
Green Lake	1	*	-	-	-	-	-	-	1	
Outagamie	*	*	-	-	-	-	-	-	-	
Sheboygan	*	-	-	-	-	*	-	-	-	
Total	12	1	*	*	-	1	-	-	2	8
State total	1,416	739	47	84	42	174	13	3	203	111

[1] Includes only those counties that supplied pulpwood in 1967.

[2] Includes 43,000 cords of birch reported as miscellaneous hardwoods in Research Note NC-59. The miscellaneous hardwood volume was reduced accordingly.

[3] County figures are not available.

* Less than 500 cords.

(Table 9 continued)

MICHIGAN

(Thousand standard cords, roughwood basis)

District & county[1]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residue & chips[2]
E. ½ UP. PEN.										
Alger	12	3	1	*	3	4	1	-	*	
Chippewa	41	17	5	*	3	9	6	1	*	
Delta	73	35	16	1	3	8	7	*	3	
Luce	20	3	2	*	3	9	3	*	*	
Mackinac	13	6	4	*	*	1	2	-	*	
Menominee	100	71	13	1	1	2	10	*	2	
Schoolcraft	34	9	9	1	3	7	4	*	1	
Total	295	144	50	3	16	40	33	1	6	2
W. ½ UP. PEN.										
Baraga	66	30	3	*	9	2	5	-	17	
Dickinson	78	59	6	-	1	5	5	*	2	
Gogebic	41	19	4	*	10	*	1	*	7	
Houghton	65	14	4	1	14	2	6	-	24	
Iron	86	60	6	1	3	1	6	*	9	
Keweenaw	5	-	2	-	-	-	3	*	-	
Marquette	79	26	12	*	2	26	13	-	*	
Ontonagon	56	29	1	*	5	*	1	*	20	
Total	508	237	38	2	44	36	40	*	79	32
N. ½ LOW. PEN.										
Alcona	53	37	*	2	-	4	*	-	10	
Alpena	12	7	*	1	-	*	1	-	3	
Antrim	*	*	-	-	-	-	-	-	-	
Arenac	1	1	-	-	-	-	-	-	-	
Benzie	6	3	-	-	-	-	-	-	3	
Cheboygan	10	5	*	1	-	3	*	-	1	
Clare	29	26	-	-	-	1	-	-	2	
Crawford	23	3	-	-	-	19	-	-	1	
Gladwin	4	2	-	-	-	*	-	-	2	
Grand Traverse	14	8	-	-	-	3	-	-	3	
Iosco	12	6	1	*	-	4	1	-	*	
Isabella	5	5	-	-	-	*	-	-	*	
Kalkaska	11	6	*	-	-	4	*	-	1	
Lake	41	7	-	-	-	13	-	-	21	
Leelanau	1	1	-	-	-	*	-	-	*	
Manistee	47	15	-	-	-	2	-	-	30	
Mason	7	4	-	-	-	*	-	-	3	
Mecosta	14	10	-	-	-	-	-	-	4	
Midland	1	1	-	-	-	-	-	-	*	
Missaukee	15	12	*	-	-	1	-	-	2	
Montmorency	31	19	1	1	-	4	*	-	6	
Newaygo	16	11	-	-	-	2	-	-	3	
Oceana	5	3	-	-	-	1	-	-	1	
Ogemaw	12	5	-	*	-	6	-	-	1	
Osceola	11	9	-	-	-	*	-	-	2	
Oscoda	52	21	*	*	-	27	*	-	4	
Otsego	4	*	*	-	-	4	*	-	*	
Presque Isle	15	9	1	1	-	2	*	-	2	
Roscommon	23	12	*	-	-	7	-	-	4	
Wexford	21	10	-	-	-	8	-	-	3	
Total	507	258	3	6	-	115	2	-	112	11

(Table 9 continued)

MICHIGAN (continued)

(Thousand standard cords, roughwood basis)

District & county[1]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residue & chips[2]
S. ½ LOW. PEN.										
Allegan	1	*	-	-	-	-	-	-	1	
Barry	*	*	-	-	-	*	-	-	*	
Berrien	*	*	-	-	-	-	-	-	-	
Cass	*	-	-	-	-	*	-	-	-	
Gratiot	*	*	-	-	-	-	-	-	*	
Ionia	*	-	-	-	-	*	-	-	-	
Kalamazoo	*	-	-	-	-	*	-	-	-	
Kent	1	1	-	-	-	*	-	-	*	
Lapeer	*	*	-	-	-	-	-	-	-	
Montcalm	7	6	-	-	-	*	-	-	1	
Muskegon	1	*	-	-	-	1	-	-	-	
Ottawa	1	*	-	-	-	1	-	-	-	
St. Clair	*	*	-	-	-	-	-	-	-	
St. Joseph	*	*	-	-	-	-	-	-	*	
Tuscola	*	*	-	-	-	-	-	-	-	
Van Buren	*	-	-	-	-	-	-	-	*	
Total	34	7	-	-	-	2	-	-	2	23
State total	1,344	646	91	11	60	193	75	1	199	68

[1] Includes only those counties that supplied pulpwood in 1967.

[2] County figures are not available.

* Less than 500 cords.

(Table 9 continued)

MINNESOTA

(Thousand standard cords, roughwood basis)

District & county[1]	All species	Aspen	Balsam	Birch	Pine	Spruce	Tamarack	Misc. hdwds.	Residue & chips[2]
NORTHEASTERN:									
Carlton	24	20	1	1	1	*	1	*	
Cook	45	*	2	-	6	37	-	-	
Lake	54	13	3	-	24	14	-	*	
Pine	10	8	*	-	1	*	*	1	
St. Louis	315	164	20	*	76	42	5	8	
Total	459	205	26	1	108	93	6	9	11
CENTRAL PINE:									
Aitkin	53	39	3	-	1	3	4	3	
Becker	2	1	*	-	1	*	*	-	
Beltrami	83	39	10	1	12	14	7	-	
Cass	56	35	2	1	10	2	6	*	
Clearwater	69	56	1	-	6	2	2	2	
Crow Wing	11	4	1	-	6	*	*	-	
Hubbard	29	15	*	-	11	1	2	-	
Itasca	128	71	13	-	14	23	6	1	
Wadena	13	5	-	-	8	-	-	-	
Total	453	265	30	2	69	45	27	6	9
RAINY RIVER:									
Koochiching	205	104	20	-	7	47	4	23	
Lake of the Woods	40	4	*	-	4	32	-	-	
Total	249	108	20	-	11	79	4	23	4
HARDWOOD:									
Mille Lacs	2	1	-	-	-	*	*	1	
Morrison	5	5	-	-	*	-	-	-	
Scott	*	*	-	-	*	-	-	*	
Todd	1	-	-	-	1	-	-	-	
Total	20	6	-	-	1	*	*	1	12
PRAIRIE:									
Mahnomen	2	2	-	-	*	*	*	-	
Marshall	*	*	-	-	-	-	-	-	
Norman	*	*	-	-	-	-	-	-	
Polk	3	1	-	-	*	1	1	-	
Roseau	19	4	-	-	13	*	2	-	
Total	24	7	-	-	13	1	3	-	-
State total	1,205	591	76	3	202	218	40	39	36

[1] Includes only those counties that supplied pulpwood in 1967.

[2] County figures are not available.

* Less than 500 cords.

Table 10. — Central States pulpwood production and receipts, by State, 1967
(In standard cords unpeeled)[1]

Species group and destination	Production by States[2]					Imports			Total Receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake states	Other U.S.	Total Imports	
oftwoods									
Illinois	2,846	-	-	-	2,846	-	-	-	2,846
Ind., Iowa, Mo.[3]	-	-	-	-	-	-	-	-	-
Exported[4]	-	89	-	-	89	-	-	-	-
Total	2,846	89	-	-	2,935	-	-	-	2,846
oft hardwoods									
Illinois	33,984	1,089	-	1,089	36,162	-	6,111	6,111	42,273
Ind., Iowa, Mo.	10,222	28,545	11,675	17,946	68,388	813	2,570	3,383	71,771
Exported[4]	-	166	-	-	166	-	-	-	-
Total	44,206	29,800	11,675	19,035	104,716	813	8,681	9,494	114,044
ard hardwoods									
Illinois	10,921	3,918	-	1,400	16,239	-	1,554	1,554	17,793
Ind., Iowa, Mo.	10,921	32,887	15,365	762	59,935	3,480	2,627	6,107	66,042
Exported[4]	-	2,080	-	-	2,080	-	-	-	-
Total	21,842	38,885	15,365	2,162	78,254	3,480	4,181	7,661	83,835
otal roundwood									
Illinois	47,751	5,007	-	2,489	55,247	-	7,665	7,665	62,912
Ind., Iowa, Mo.	21,143	61,432	27,040	18,708	128,323	4,293	5,197	9,490	137,813
Exported[4]	-	2,335	-	-	2,335	-	-	-	-
Total	68,894	68,774	27,040	21,197	185,905	4,293	12,862	17,155	200,725
Residues, softwood									
Illinois	6,510	-	-	-	6,510	4,172	-	4,172	10,682
Ind., Iowa, Mo.	-	-	-	-	-	-	-	-	-
Exported[4]	-	-	-	-	-	-	-	-	-
Total	6,510	-	-	-	6,510	4,172	-	4,172	10,682
Residue, hardwoods									
Illinois	10,726	-	-	15,734	26,460	1,295	12,011	13,306	39,766
Ind., Iowa, Mo.	9,622	10,999	8,021	177	28,819	4,117	4,307	8,424	37,243
Exported[4]	187	4,700	282	-	5,169	-	-	-	-
Total	20,535	15,699	8,303	15,911	60,448	5,412	16,318	21,730	77,009
All wood material									
Illinois	64,987	5,007	-	18,223	88,217	5,467	19,676	25,143	113,360
Ind., Iowa, Mo.	30,765	72,431	35,061	18,885	157,142	8,410	9,504	17,914	175,056
Exported[4]	187	7,035	282	-	7,504	-	-	-	-
Total	95,939	84,473	35,343	37,108	252,863	13,877	29,180	43,057	288,416

1/ Factors used in converting to standard green cords (128 cu.ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard-hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

2/ Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

3/ Combined to prevent disclosure of individual mill receipts.

4/ Pulpwood shipped to mills outside the region.

Reports on Pulpwood Production
Published by the
North Central Forest Experiment Station

Reports of pulpwood production in the Lake States have been published by the Station since 1946. One group of short notes gives annual data by State and species. Another group of longer reports begun in 1959 gives more detailed information by County; in 1965, we began including data for four Central States in this report. The longer reports are:

Pulpwood Production in Lake States Counties, by Arthur G. Horn.

1959 data: Station Paper 85, 13 p.
1960 data: Station Paper 94, 28 p.
1961 data: Station Paper 106, 18 p.
1962 data: Research Paper LS-5, 16 p.
1963 data: Resource Bulletin LS-1, 17 p.
1964 data: Resource Bulletin LS-2, 19 p.

Pulpwood Production and Consumption in the North Central Region by County, by James E. Blyth.

1965 data: Resource Bulletin NC-2, 24 p.
1966 data: Resource Bulletin NC-3, 27 p.

The serial numbers of the brief Notes for the past 10 years are:

1958: Tech. Note 558
1959: Tech. Note 588
1960: Tech. Note 606
1961: Tech. Note 624
1962: Research Note LS-23
1963: Research Note LS-48
1964: Research Note LS-65
1965: Research Note NC-3
1966: Research Note NC-31
1967: Research Note NC-59

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- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
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S. D. A. FOREST SERVICE
RSOURCE BULLETIN NC-7
1969

Indiana's Timber

by
John S. Spencer, Jr.

CLEMSON
FEB
S.C. TECH. & AGR. DIV.

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

FOREWORD

This is a report on the second comprehensive survey of Indiana's forest resources. The report on the first inventory, made between November 1949 and December 1950, was entitled "Indiana's Forest Resources and Industries," Forest Resource McNary Forest Research Act of 1928. Fieldwork for the second Survey began in are part of the nation-wide Forest Survey program authorized by the McSweeney-McNary Forest Research Act of 1928. Fieldwork for the second Survey began in August 1966 and was completed in June 1967.

The timber resource of Indiana has changed in many ways since the first Survey. Some of the changes are due to differences in land use and development, timber cutting, tree growth, tree planting and mortality. These changes and their impact on timber supply are explored in the report.

The Survey was made by the North Central Forest Experiment Station, U.S.D.A. Forest Service, with financial support from the Forestry Division, Indiana Department of Natural Resources. The Department of Natural Resources and the Indiana Extension Foresters assisted in a canvass of timber use in Indiana, and Purdue Universisty also assisted in a special study of walnut utilization. The Eastern Region of the U.S.D.A. Forest Service financed data collection on the Hoosier National Forest; the Agricultural Stabilization and Conservation Service provided the necessary aerial photos.

North Central Forest Experiment Station
D. B. King, Director
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THE AUTHOR, a Resource Analyst, is headquartered at the Station's main office in St. Paul, which is maintained in cooperation with the University of Minnesota.

COVER PHOTO: A forest road through a hardwood stand in the Morgan-Monroe State Forest near Martinsville, Indiana. (Photo courtesy of the Indiana Department of Natural Resources)

HIGHLIGHTS

Timber Volume

- The 1967 volume of growing stock on commercial forest land was 3.5 billion cubic feet, a gain of 25 percent over the 2.8 billion cubic feet in 1950.
- Sawtimber volume was 10.9 billion board feet in 1967, compared with 8.7 billion board feet in 1950.
- The average volume per acre of growing stock rose from 683 cubic feet in 1950 to 899 cubic feet in 1967.
- Sawtimber average volumes per acre were 2,140 board feet in 1950 and 2,794 board feet in 1967.
- Hardwoods, principally oaks, hickory, and hard maple, comprise 98 percent of the State's volume of growing stock.
- Farmers and other individuals own eighty-eight percent of the growing-stock volume.
- In addition to the growing-stock volume, rough and rotten tree volume amounts to 380 million cubic feet and salvable dead tree volume totals 22 million cubic feet.

Stand Conditions

- Net annual growth on growing stock in 1967 was 95.1 million cubic feet and exceeded timber removals by one-third.
- The net annual growth rate averaged 2.7 percent of the inventory of growing stock in 1967. This compares with a 1950 growth rate of 3.8 percent of inventory.
- Growing-stock mortality was 11.7 million cubic feet in 1967 or 0.3 percent of inventory. Diseases accounted for nearly half the mortality.
- About 50 percent of the butt logs of sampled sawtimber trees were in Grades 1 and 2, best of the four log grades used.

Forest Area

- Indiana has 4 million acres of forest land, which amounts to 17 percent of the State's land area.
- The commercial forest included 3.9 million acres in 1967, a slight drop from the 4.1 million acres in 1950.
- The two most extensive forest types are the oak-hickory type, with 61 percent of the commercial area, and the maple-beech-birch type, with 20 percent.
- Farmers own 68 percent of the commercial forest area, mostly in tracts of less than 100 acres.

Timber Use

- Growing-stock removals in 1966 amounted to 64.9 million cubic feet, about two-thirds of the net annual growth and a little more than half of the allowable annual cut.
- Sawtimber removals were 345 million board feet in 1966, 50 percent greater than net growth but only 80 percent of the allowable annual cut.
- Total timber products output in 1966 was 51.1 million cubic feet of roundwood and 9.3 million cubic feet of plant residues.
- Saw logs accounted for two-thirds of the 1966 roundwood products output.
- The number of active, primary wood-using mills and plants dropped from 1,149 in 1949 to 518 in 1966. Four hundred and eighty of the 1966 mills were sawmills.
- Growing-stock removals are projected to increase 58 percent by 1997. Growth on growing stock is projected to remain above removals during this period, however, resulting in a larger inventory in 1997 than in 1966.
- The sawtimber inventory is projected to decrease substantially between 1966 and 1997, because of a continuing excess of sawtimber removals over growth.

INDIANA'S TIMBER

John S. Spencer, Jr.

PRESENT TIMBER SUPPLY

Indiana's woodlands range from farm woodlots tting the countryside in the northern half of the ate to nearly continuous forest cover in parts of the uthern half. The generally deep, fertile soils of the rth are used principally for agriculture. The south, hich contains the bulk of the State's commercial rest land[1], has a mixture of deep soils along the ver bottoms and less fertile soils among the low hills.

Indiana's forests are almost exclusively hardwood; e most common species — white oaks, hickory, ack oaks, and hard maple — usually grow in mixre with a variety of other central hardwoods (fig.). Many of these hardwoods are valuable for furnire, flooring, veneer and other products. Most valule of all is the much sought-after black walnut.

The value of Indiana's woodlands is not reprented solely by forest products, because few forests day are managed only for wood production. Outor recreation, wildlife habitat, and watershed proction are other important benefits, and they promise be even more important in the future. But this port is concerned primarily with timber, and the iscussion that follows is limited to that resource.

rowing-Stock Volume on the Increase

Indiana's 1967 volume of live, sound (growingock) trees totaled 3.5 billion cubic feet, an increase more than 25 percent since 1950. This gain was ade despite a statewide decline of 4.6 percent in mmercial forest land area. Commercial forest area creased in the southern portion of the State where e greatest timber volume is found, however. Average rowing-stock volume per acre was 900 cubic feet in 967 compared with 680 cubic feet in 1950. The rincipal reason for the increase in growing-stock ventory is the continuing surplus of net annual rowth over timber removals. In 1950 growth exceeded removals by a ratio of more than 2 to 1, and in 1967 by a ratio of 3 to 2. The limited market for poletimber-size trees is the major reason growing-stock removals have not been higher, but the pulpwood market for small hardwoods is expected to improve greatly in the future. Timber volume increased in most diameter groups, although it increased most in the 12 to 14-inch diameter group (fig. 2).

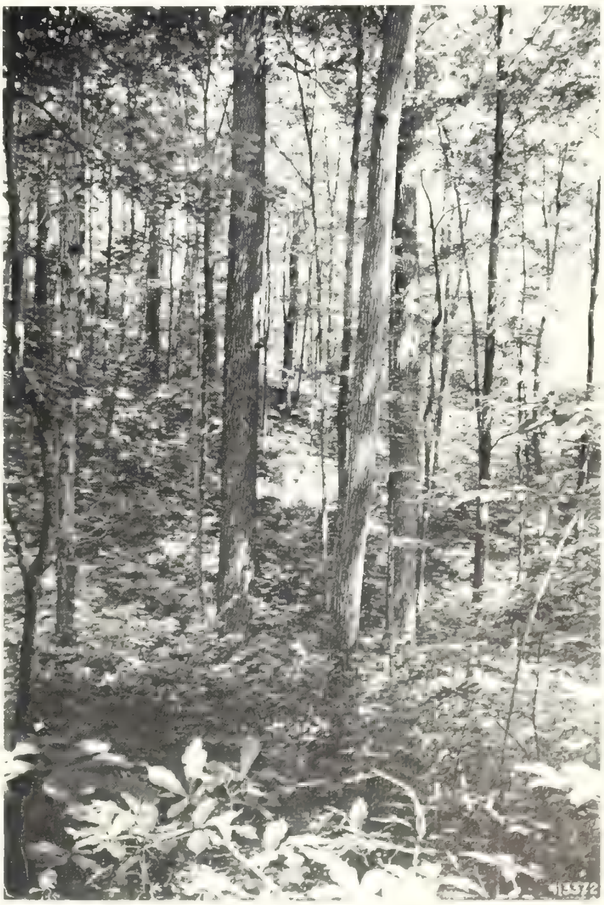

Figure 1. — A high-quality sawtimber stand in the oak-hickory type, the largest forest type in Indiana.

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[1] *Land that is producing or is capable of proucing crops of industrial wood and is not withdrawn om timber utilization.*

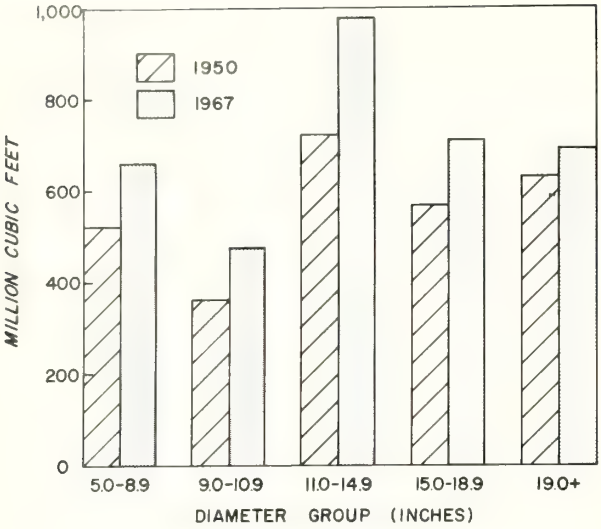

Figure 2. — Growing - stock volume by diameter groups, 1950 and 1967.

Hardwoods make up 98 percent of the growing-stock volume, and five species contain over half the total volume — white oak (14 percent), hickory (13 percent), black oak (9 percent), hard maple (8 percent), and northern red oak (8 percent). The volumes of nearly all species increased between 1950 and 1967 (fig. 3). The major exception was elm, which dropped from 265 million cubic feet in 1950 to million cubic feet in 1967, primarily because of m tality due to elm diseases.

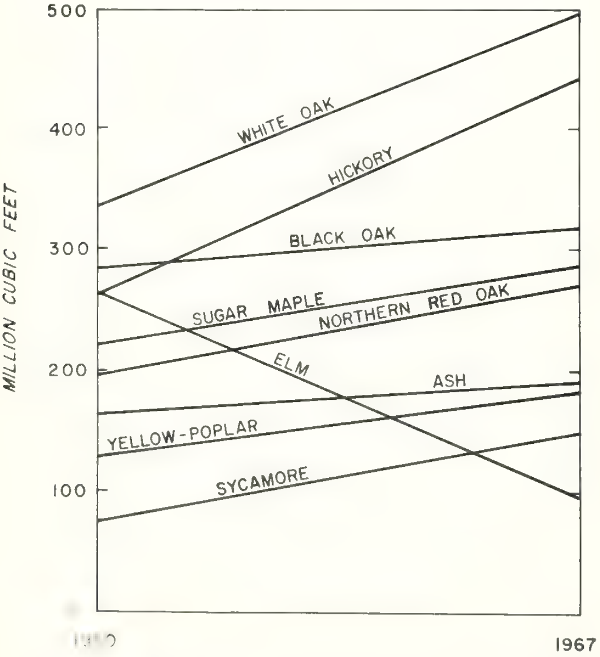

Figure 3. — Change in growing-stock volume for most major species in Indiana, 1950 and 1967.

Small sawtimber-sized trees contain the lar share of growing-stock volume. Two-thirds of sound, live volume is in trees 11 inches in diame at breast height (d.b.h.) and larger, but only o fifth is in trees 19 inches d.b.h. and larger. The inch diameter class contains the most volume.

Eighty-eight percent of Indiana's growing-st volume is owned by farmers and other individu The three southern Forest Survey Units (fig. 4) c tain three-fourths of the State's growing-stock v ume, with the Knobs Unit alone containing nea half the total volume (1.7 billion cubic feet). M

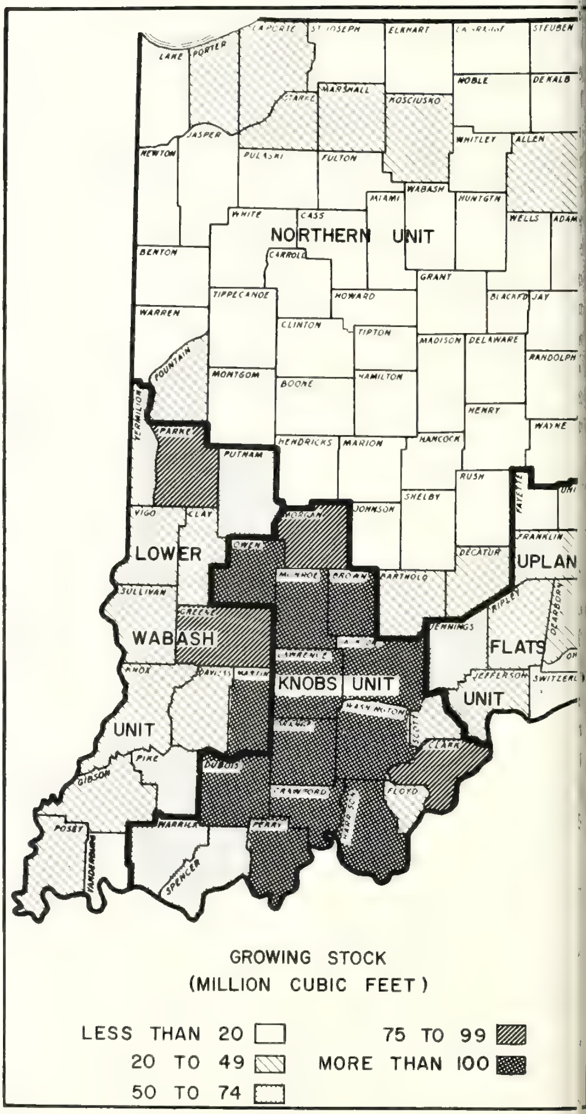

Figure 4. — Location of Forest Survey Units in In ana, and growing-stock volume by counties, 1967

the small volume of softwoods is also found in this
ly Unit. Perry County has the largest volume of
owing stock in the State (146 million cubic feet),
lowed closely by Brown and Washington Counties
44 and 143 million cubic feet, respectively). The
wer Wabash Unit contains 22 percent and the
pland Flats Unit 7 percent of the State's growing-
ck volume.

Between 1950 and 1967, growing-stock volume in
e three southern Units increased 50 percent, consid-
ably more than the statewide volume gain of 25
rcent. Average volume per acre in the southern
its climbed from 600 cubic feet in 1950 to 925
bic feet in 1967.

The Northern Unit, which contained 1.0 billion
bic feet of growing stock in 1950, declined to 0.8
lion cubic feet in 1967, largely because of the heavy
n mortality and a 20 percent loss in commercial
est area. The average volume slipped from 860 to
0 cubic feet per acre.

In addition to the 3.5 billion cubic feet of growing
ck, there are 380 million cubic feet of sound wood
cull trees and 22 million cubic feet in salvable dead
es in Indiana. Most of the cull volume is in rough
es, or trees classed as culls because of roughness,
or form or noncommercial species. Only a small
rtion of this volume is currently merchantable, but
proving markets for pulpwood and chips should
nsume more of it in the future. The total of all
nber in Indiana, then, is estimated to be 3.9 billion
bic feet.

Sawtimber Volume

The sawtimber volume increase between surveys
s similar to the growing-stock volume increase. The
67 sawtimber volume was estimated to be 10.9 bil-
n board feet,[2] a 25-percent gain over the adjusted
lume of 8.7 billion board feet in 1950.[3] The volume
creased despite removals during part of the period
at exceeded net growth, a modest loss of commer-
l forest area, and an increase in sawtimber mor-
ity, especially for elm.

The increase of sawtimber volume was not uniform throughout the State. The volume increased by two-thirds in the south between surveys, while the volume decreased by one-third in the north:

	1950	*1967*
	(Million board feet)	
South	5,064	8,394
North	3,672	2,491
Total	8,736	10,885

The five species that contain most of the growing-stock volume also contain most of the sawtimber volume, but in different order. White oak remains first with 15 percent of the sawtimber volume, but black oak is second with 11 percent, followed by hickory (11 percent), northern red oak (10 percent), and hard maple (7 percent). Although white oak and hickory increased substantially in volume between surveys, most species increased only slightly, and a few declined (fig. 5). Elm volume dropped drastically.

Sawtimber volume was greater in 1967 in all diameter groups than in 1950 (fig. 6). In addition, a higher proportion of the volume was in small-diameter trees in 1967 than in 1950. Proportionately heavier cutting of large-diameter trees, the major cause of this volume buildup in small trees, will probably continue for some time.

An estimate of quality in Indiana's forests was made by grading the butt log in each sawtimber tree sampled during the 1967 survey. As seen in the following tabulation, 49 percent of the sampled butt logs

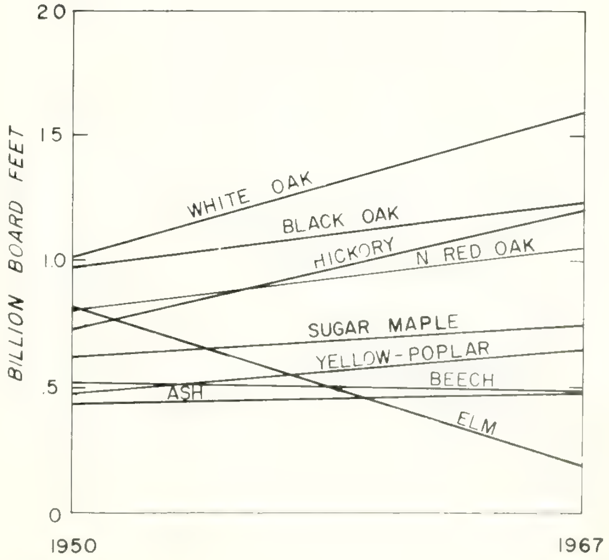

Figure 5. — Change in sawtimber volume for most major species in Indiana, 1950 and 1967.

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[2] *Board-foot volume in saw logs and sawtimber*
es is based on International 1/4-inch log rule in
is report.

[3] *The 1950 sawtimber inventory, growth, and*
rtality volumes used throughout this report do not
rrespond to volumes shown in the publication, "In-
ana's Forest Resources and Industries," by O. Keith
utchison, U.S. Dep. Agr. Forest Resource Rep. 10,
gust 1956. See Appendix for explanation.

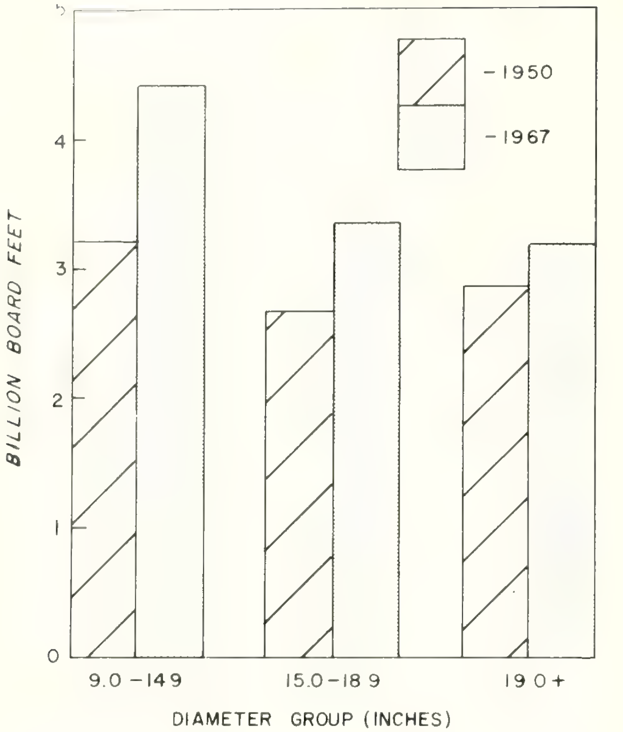

Figure 6. — Sawtimber volume by diameter groups, Indiana, 1950 and 1967.

in Indiana were in the best log grades (Grades 1 and 2)[4]:

Log grade	*Percent*
1	17
2	32
3	46
4	5

The percentage of sawtimber trees with a Grade 1 butt log was especially high for cottonwood. It was also high for "other select white oaks",[5] basswood, and sycamore — species that are in much less demand than cottonwood.

Of course, the butt log does not provide an accurate measure of total quality because it is usually the best log in the tree. For this reason the butt log quality estimates were converted into whole-tree log-grade estimates by using data collected in adjoining states. The percent of total sawtimber volume in each log grade based on these whole-tree estimates is as follows:

Log grade	*Percent*
1	24
2	26
3	38
4	12

Net Growth Rate Falls Since 1950

Net annual growth on growing-stock trees amo ed to 106.6 million cubic feet in 1950, or 3.8 per of the inventory. In 1966 the net growth was slig lower, at 95.1 million cubic feet; growth rate, h w ever, was only 2.7 percent of the inventory.

Sawtimber net annual growth dropped even fa between surveys. The growth rate in 1950 was percent (436.0 million board feet), compared t 2.1 percent (225.8 million board feet) in 1966.

High mortality was a major reason for the dec in growth rate. In general, growing-stock tree in 1966 did not grow appreciably slower than they id in 1950, but more of them died. However, sawtin e trees apparently did grow more slowly in 1967 t in 1950, in addition to having an increase in mo ity. Part of the growth-rate decline can also be x plained by the decrease in commercial forest lan in the north, where the growth rate is the highest in e State. In addition, the mortality of elm, a fast-gr w ing species on moist sites, was extremely high. St "high-grading," a common practice in Indiana, s has a depressing effect on growth rates. In this t of harvest the high-value trees are removed and s d but low-value trees, which are often slow-growing cull trees, are left standing.

Net annual growth on growing stock exceeds n nual removals by a margin of 3 to 2. In 1966, gro th was 95.1 million cubic feet and removals 64.9 mil n cubic feet. This excess of growth over removals is e primary cause of the increase in inventory betw n surveys.

Sawtimber removals, on the other hand, w re greater than net growth in 1966 — 345 million bo d feet (3.2 percent of inventory), compared with 6 million board feet of net growth (2.1 percent of n ventory). The situation is somewhat different fr n that of 1950 when sawtimber removals were 2.9 p r cent of inventory and net growth was nearly tw e the 1966 amount.

The margin of sawtimber removals over growth n 1966 varied widely by species; several species d more growth than removals (fig. 7). Sugar ma e was harvested intensively, about two and one-h lf times faster than net growth, and black walnut s timber removals (not shown in figure 7) were m e than four times growth.

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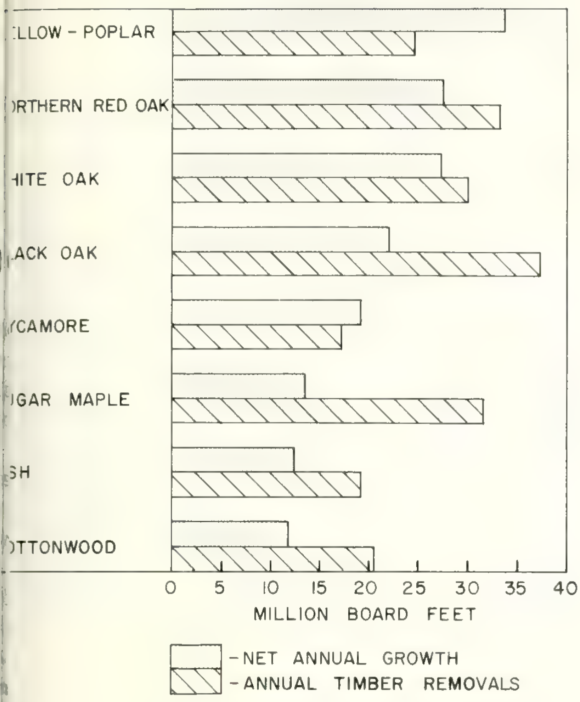
[4] *See "Definitions of terms" in Appendix for [illegible] used in log grading.*

[5] *"Other select white oaks" include swamp white oak, [illegible] oak, swamp chestnut oak, and chinkapin oak.*



ure 7. — Comparison of sawtimber net annual rowth and annual timber removals for some major pecies in Indiana, 1966.

Removals Less Than Allowable Cut

nnual allowable cut is the volume that could be while bringing the forest to a more productive dition and improving the distribution of age sses. It assumes that all lands will be managed the e way regardless of owner, and at an intensity ilar to that practiced on National Forest lands. owable cut is merely a guide (See Survey Proce- e in appendix), but it is a better figure with ich to compare timber removals than net growth ause it incorporates the level of cutting suggested a forest not yet regulated. When a forest becomes ulated or fully managed, allowable cut and growth l be equal.

ven though more sawtimber volume is being re- ved than is being grown, still more volume could removed in each of the next 10 years within the mated annual allowable cut. As explained more ly later, this allowable cut is suggested for only years in order to harvest the many timber stands t are older than the prescribed rotation age, after ich it will be greatly reduced.

n comparing allowable cut and 1966 removals, s clear that removals could be higher. Sawtimber novals were only about 80 percent and growing-stock removals 55 percent of allowable cut. However, much of the difference between the volume of current removals and allowable cut is in species for which there is low demand presently; this is especially true for sawtimber. The species for which allowable cut is greater than present removals include white oak, chestnut oak, post oak, hickory, tupelo, black gum, black cherry, elm, cypress and sycamore. (See tables 40, 42, 58, and 59 in Appendix for comparisons of removals with allowable cut for individual species.) The Northern and Upland Flats Units are being harvested closer to the allowable cut volume than the other two Units (fig. 8).

The rate of growth and removals is highest in northern Indiana, in spite of the fact that nearly 80 percent of the State's timber volume is in the south. Northern Indiana's growing-stock inventory is 22 percent of the State's total, but its removals are 34 percent and its growth 36 percent of the total. In contrast, the Knobs Unit, which has 49 percent of Indiana's inventory of growing stock, contributes only 41 percent of the total growth and 32 percent of the total removals. Even though the north has mostly small timber tracts interspersed throughout the farmlands, these tracts have the highest growth rates in the State and are utilized more intensively than the more continuous stands in the south. Part of the reason for high timber removals in the north is the high proportion of large and medium-sized sawmills in that part of the State (although most of the sawmills are in southern Indiana), and the comparatively high percentage of large-diameter trees. Northern Indiana contains 34 percent of all trees 23 inches d.b.h. and larger.

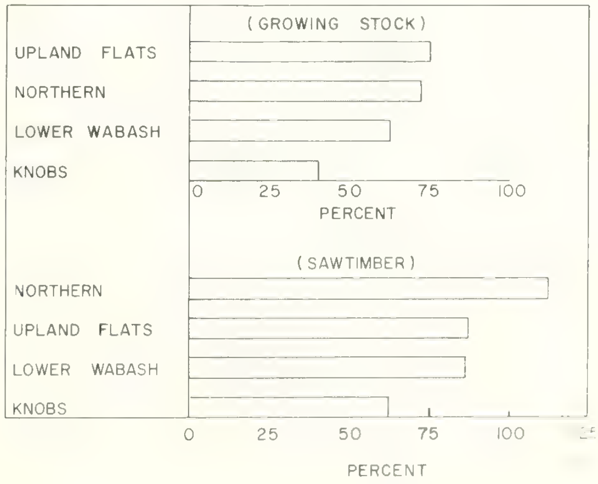


Figure 8. — Percent of annual allowable cut removed in each Survey Unit in Indiana, 1966.

Mortality Climbs

Tree mortality nearly doubled between 1950 and 1966 — growing-stock mortality was only 6.2 million cubic feet in 1950 compared with 11.7 million cubic feet in 1966. Sawtimber mortality increased even faster — from 15.0 million board feet in 1950 to 31.3 million board feet in 1966.

Mortality was particularly high for elm in 1966, averaging 2.8 percent of its growing-stock inventory and 4.8 percent of its sawtimber inventory. The elm diseases, principally Dutch elm disease and to a lesser extent phloem necrosis, were responsible for most of this loss. No other species had as high a mortality rate as elm.

Diseases accounted for nearly half the growing-stock mortality volume and slightly more than half the sawtimber mortality. Other causes of death, principally old-age and suppression by larger trees, were responsible for about one-fourth of the mortality.

Large-Diameter Black Walnut Trees Diminishing

Black walnut deserves special mention because of its high value and short supply of large-diameter trees in Indiana and throughout its entire range. Between 1950 and 1967 black walnut growing-stock volume on commercial forest land remained surprisingly constant. Volume losses in the larger diameter groups were more than offset by gains in the smaller diameter groups, as seen in the following tabulation:

Diameter group	*Black walnut growing-stock volume*	
	1950	*1967*
	(Million cubic feet)	
5.0- 8.9	15.9	16.0
9.0-10.9	10.1	9.4
11.0-14.9	17.1	22.9
15.0-18.9	14.4	12.5
19.0+	5.4	3.7
Total	62.9	64.5

Sawtimber volume of walnut also increased slightly between surveys (fig. 9). A substantial gain was made in the 11.0- to 14.9-inch diameter group, but all other classes showed losses:

Diameter group	*Black walnut sawtimber volume*	
	1950	*1967*
	(Million board feet)	
11.0-14.9	75.0	100.0
15.0-18.9	71.0	61.7
19.0+	23.0	16.1
Total	169.0	177.8

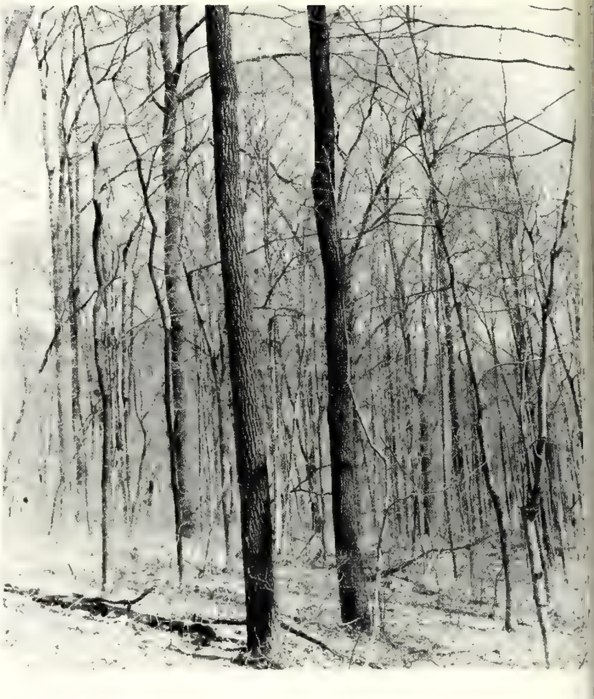


Figure 9. — Two black walnut sawtimber trees in mixed hardwood stand in Indiana. Indiana's bla walnut sawtimber volume on commercial fore land amounts to about 7 percent of the Natio total.

Walnut trees growing on nonforest land and shor log trees on commercial forest land contain a volum of 17 million cubic feet in Indiana. Short-log tre are those that are not included under growing stoc because they contain only 8- to 11-foot saw log This volume swells the total usable walnut volum by 26 percent when it is added to the 64.5 millio cubic feet of growing stock in the commercial fore (table 1). Walnut sawtimber volume on nonfore land and in short-log trees amounted to 41 millio board feet, in addition to the 178 million board fee on commercial forest land.

Table 1. — *Black walnut volume on commercia forest and nonforest land by diamete groups, Indiana, 1967*

Diameter group	On commercial forest land		On nonforest land		Total
	Growing-stock trees	Short-log trees	Growing-stock trees	Short-log trees	
	(Million cubic feet)				
5.0- 8.9	16.0	(1/)	0.6	(1/)	16.6
9.0-10.9	9.4	(1/)	.8	(1/)	10.2
11.0-14.9	22.9	1.9	2.4	1.3	28.5
15.0-18.9	12.5	4.1	3.1	.2	19.9
19.0+	3.7	.1	1.3	1.2	6.3
Total	64.5	6.1	8.2	2.7	81.5

1/ Poletimber-size trees are not classed as short-log trees.

FOREST AREA

One Out of Every Six Acres Is Forested

Of the 23.2 million acres of land in Indiana, almost 4.0 million acres (17 percent) are forested. Nearly all (98 percent) of the forest land is commercial forest. As shown in figure 10, the most intensively forested area in the State is the Knobs Unit, where almost one-half of the State's total commercial forest area is located. The counties with the largest commercial forest areas — Perry, Monroe, Brown, and Harrison — are in the Knobs Unit.

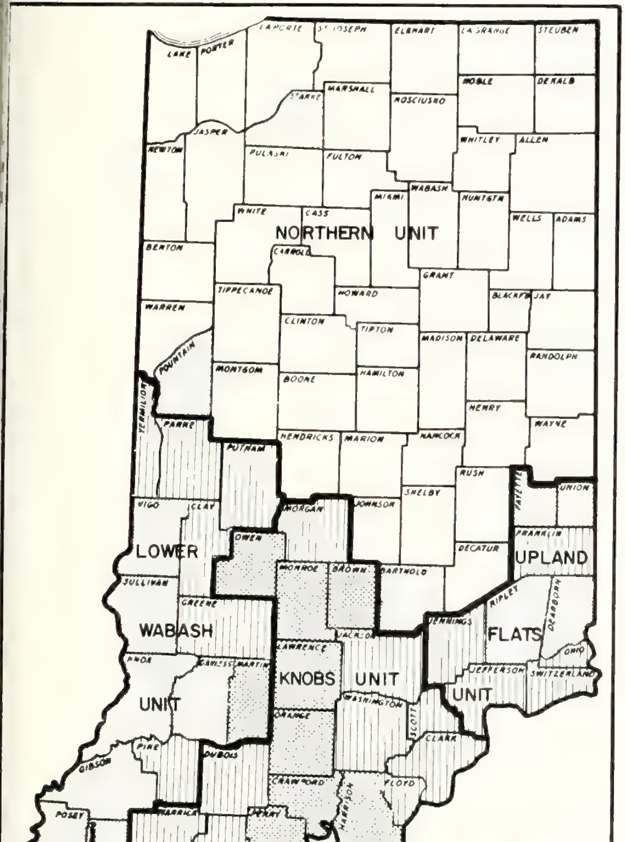


Figure 10. — Percent of land area in commercial forest by county, Indiana, 1967.

The Lower Wabash Unit is flat-to-rolling and contains the wide valleys of the Wabash and White Rivers. About one-fifth of the State's commercial forest area is in this Unit. The Upland Flats Unit contains less than 10 percent of the commercial forest area in the State. Soils in the Northern Unit are level, fertile, and used largely for farming, but the scattered commercial forest area still amounts to nearly one-quarter of the State's total. The following tabulation shows the proportion of commercial forest land in each Unit:

Forest Survey Unit	*Area of commercial forest land* (Thousand acres)	*Percent of State total*
Lower Wabash	836.2	21
Knobs	1,769.2	46
Upland Flats	353.7	9
Northern	936.7	24
All units	3,895.8	100

The modest overall decline in commercial forest from 4.1 million acres in 1950 to 3.9 million acres in 1967 does not reflect the opposing trends in the northern and southern portions of the State. In the Northern Unit commercial forest area dropped 20 percent between surveys, as woodland gave way to agriculture, industrial development, and urbanization. In two of the three southern units, on the other hand, commercial area increased slightly. Of the southern group, only the Upland Flats Unit showed a decline in commercial forest acreage.

Oak-Hickory Type Has Largest Area

Oak-hickory is by far the most extensive forest type in Indiana, with more than 60 percent of the commercial area. Composed primarily of white, black, and northern red oak and hickory, it is the largest forest type in all Survey Units. Maple-beech-birch, the State's second largest forest type, accounts for 20 percent of the total commercial forest. Although distributed over the entire State, this type is most extensive in the Knobs and Northern Units. The other major forest type in terms of area is the elm-ash-cottonwood type, sometimes called the lowland hardwood type. It constitutes 14 percent of the State's commercial forest and is most common along streams and rivers in southwestern Indiana. The areas by forest types are:

Forest type	*Commercial forest area in 1967* (Thousand acres)
Oak-hickory	2,388.8
Maple-beech-birch	788.0
Elm-ash-cottonwood	553.7
Oak-gum-cypress	52.2
Loblolly-shortleaf pine	54.0
Oak-pine	46.0
Aspen-birch	13.1
All types	3,895.8

Most Commercial Forest Is Privately Owned

Ninety percent of the commercial forest area in Indiana is owned by individuals, almost 70 percent by farmers (fig. 11). The average private woodland holding is small — generally less than 100 acres. Holdings that small usually do not generate muc income for their owners, nor does their size justi the owner spending much money for timber stan improvement. Also, these landowners are not easi persuaded to practice forest management because c the long rotations required to grow trees to larg sawtimber size and hence the long wait for financi return. These are important reasons why much c Indiana's forest land is not managed more inter sively.

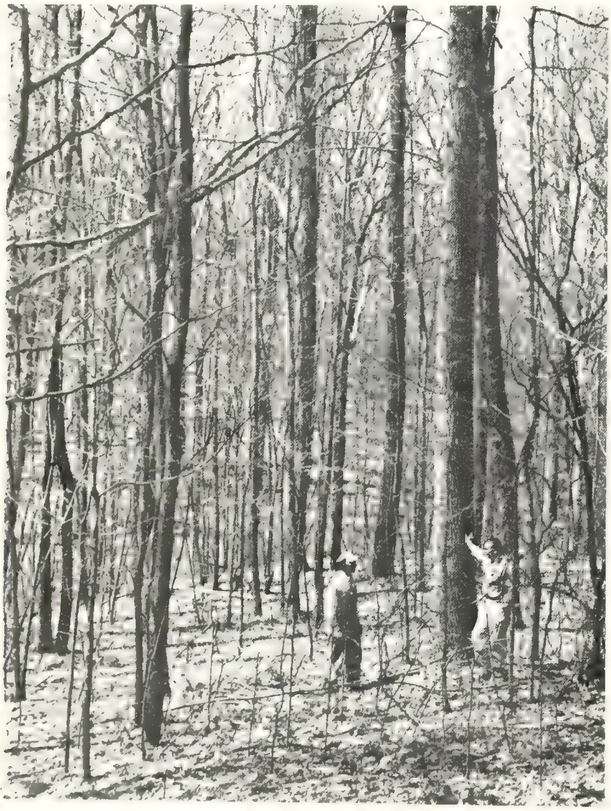


Figure 11. — A State Service Forester giving timber management assistance to a private woodland owner in Indiana. (Photo courtesy of Indiana Department of Natural Resources.)

Most of the publicly owned forest is State (14 thousand acres) or National Forest (137 thousan acres) land. Smaller areas are owned by other Fec eral agencies and by counties and municipalitie This ownership pattern has changed little betwee surveys, except that State and National Forest lanc have increased somewhat.

Sawtimber Stands Constitute Half the Commercial Forest Area

Sawtimber stands make up more than half the tot commercial forest area. Between 1950 and 1967 th area of sawtimber stands remained almost the sam However, the poletimber area went down and th sapling and seedling area went up substantially (tab 2).

Although two-thirds of all timber stands in Ind ana are less than 70 years old, poor growth in olde stands has resulted in average growth below the lev normally expected from such young trees.

Table 2. — *Comparison of 1950 and 1967 comme cial forest land area by stand-size class, Indiana*

Stand-size class	1950 area		1967 area	
	M acres	Percent	M acres	Percent
Sawtimber	2,084	51	2,037	52
Poletimber	1,337	33	866	22
Sapling & seedling	600	15	925	24
Nonstocked areas	61	1	68	2
All classes	4,082	100	3,896	100

Overall Stocking of Trees Is High

Stocking of sound, live trees in Indiana is high – in fact, more than half of the commercial forest well-stocked or overstocked with these trees. Onl 68,000 acres are less than 10 percent stocked and th require planting, seeding or other treatment to mak them productive.

In contrast, the stocking of "desirable" trees[6] — those healthy, vigorous, well-formed trees that are most likely to produce valuable products and survive to maturity — is very poor. Seventy percent of the commercial area is less than 10 percent stocked with desirable trees.

Site index[7] provides a rough measure of forest land productivity, because the most productive land generally grows the tallest trees at an index age (50 years in this report). Although site index varies widely by species, forest land in the Midwest can generally be described as follows:

Site index class	*Description*
55 or less	Poor site
56 to 70	Average site
More than 70	Good site

Site index measurements showed 60 percent of Indiana's commercial forest land to be capable of growing trees 70 feet and taller at age 50, and 95 percent to be capable of growing trees 50 feet and taller. The percent of area in each site index class for each of the three most extensive forest types in Indiana is as follows:

Site index class	*Oak-hickory*	*Maple-beech-birch*	*Elm-ash-cottonwood*
90-100	11	12	19
80- 90	19	18	27
70- 80	28	31	25
60- 70	23	25	25
50- 60	13	11	4
40- 50	5	3	0
30- 40	1	0	0
	100	100	100

PRESENT TIMBER USE

The harvest and manufacture of wood products provides substantial employment in Indiana. During 1963, the lumber, millwork, veneer, wooden container, wood preserving, furniture, paper, and allied industries employed 45,200 persons, or 7.4 percent of the State's manufacturing work force. Payroll of the timber-based industries in 1963 was $221 million, and value added by manufacture (the difference between the cost of goods purchased by an enterprise and the value of the product it sells) amounted to $406 million in 1963[8].

Total output of timber products in 1966 was 60.4 million cubic feet, including 51.1 million cubic feet of roundwood and 9.3 million cubic feet of plant residues. This represents a small decline from the 57.8 million cubic feet of roundwood output in 1949 (no estimate of plant residues was made in 1949). Growing-stock trees provided 93 percent of the roundwood volume. Logs and bolts harvested in 1966 were worth an estimated $17 million at local points of delivery.

Hardwoods accounted for practically all of the 64.9 million cubic feet of timber removals from growing stock in 1966. The hardwood removals volume was 39 percent greater than in 1949. Trees cut for products made up most of the hardwood removals (57.8 million cubic feet); the remainder of the removals came from changes in land use, land clearing, and cultural operations such as timber stand improvement. The following tabulation compares timber removals in 1950[9] and 1966 (in thousand cubic feet):

Removals	*1950*	*1966*
Hardwoods	46,320	64,500
Softwoods	151	400
Total	46,471	64,900

No single species constituted more than 11 percent of the volume of growing stock cut for products, although the red oak group (principally northern red and black oak) accounted for one-fourth of the cut. Other important species, in descending order of volume cut, were white oak, hard maple, soft maple, cottonwood, and yellow-poplar.

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[6] *Trees are classed by Forest Survey as either desirable, acceptable, rough, rotten, or short sawtimber. See Appendix for definitions.*

[7] *Site index is the height in feet of average dominant or codominant trees at a specified age (50 years in this case). For example, "site index 60" means that the height of dominant or codominant trees in the area averages 60 feet at age 50.*

[8] *Source: 1963 Census of Manufactures, U.S. Dep. Commerce, Bureau of Census.*

[9] *1950 timber removals did not include volume from "other removals," but 1966 timber removals does include this volume. "Other removals" includes growing-stock trees removed in cultural operations such as stand improvement, land clearing, and changes in land use.*

Indiana's primary wood-using plants — mostly sawmills — are concentrated in the South (fig. 12), where 66 percent of the timber-products volume was harvested in 1966. The number of active, primary wood-using plants declined from 1,149 in 1949 to 518 in 1966. Most of the plants that ceased operations were small sawmills.

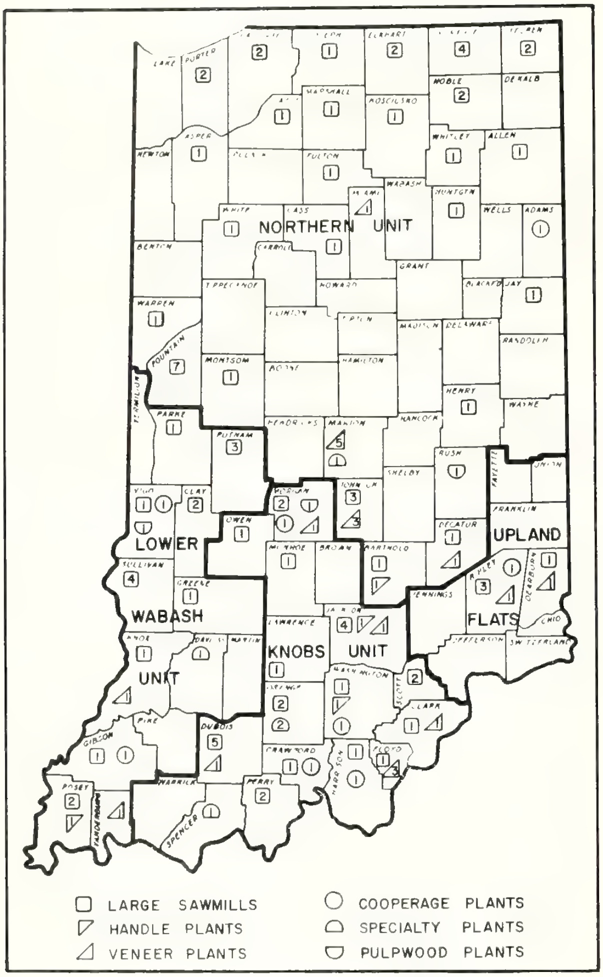


Figure 12. — Primary wood-using plants in Indiana, 1966. Number in symbol indicates number of plants in county. Large sawmills are those cutting over 1 million board feet.

Saw-Log Production Climbing

Saw logs and bolts accounted for two-thirds of the timber-products output from growing stock in 1966. Loggers harvested 223 million board feet of saw logs, of which only 7 million board feet were shipped from Indiana to other States, namely Illinois, Kentucky, Ohio, and Michigan. The saw-log harvest was 38 percent greater than in 1949.

Saw logs and bolts accounted for 54 percent of t total timber products output (from growing sto nongrowing stock and plant residues) in 1966 (f 13).

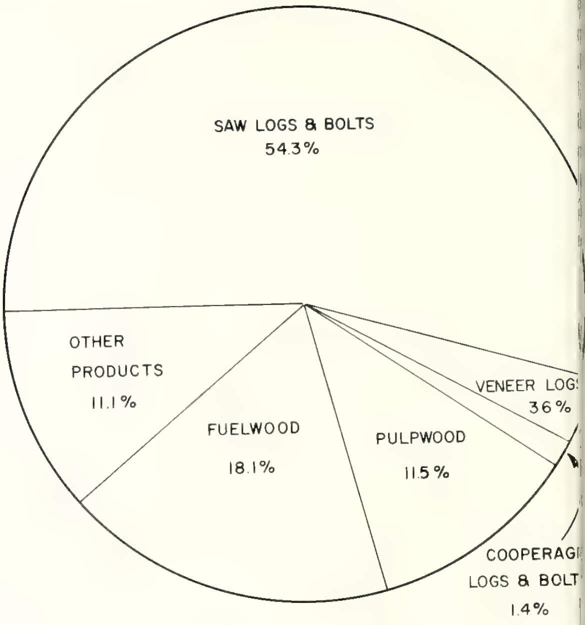


Figure 13. — Distribution of total timber produc output (60,358 thousand cubic feet) in India 1966.

From a peak of slightly more than 1 billion boa feet at the turn of the century, Indiana lumber pr duction fell off to a depression-period low of 70 m lion in 1932, and then slowly increased to 178 milli in 1966 (fig. 14). Nearly all lumber manufactured

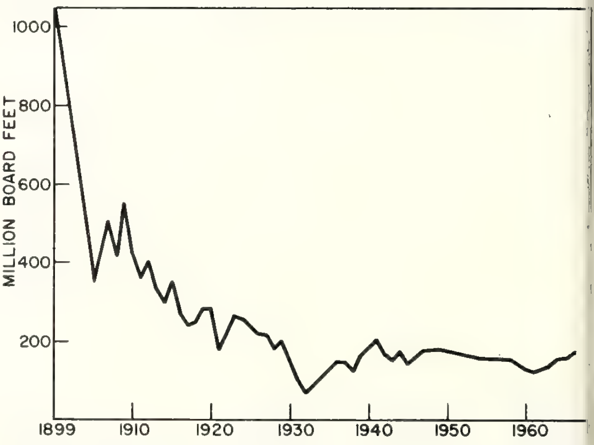


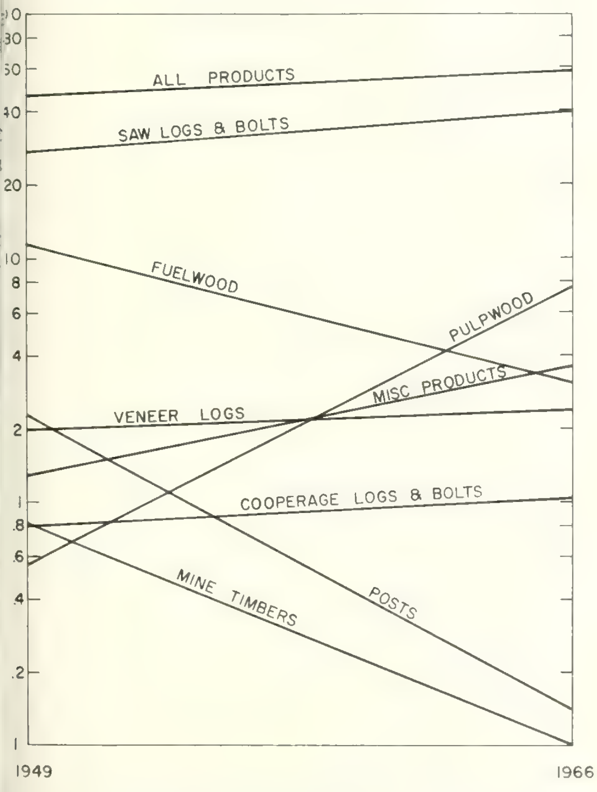
Figure 14. — Lumber production in Indiana, 1899 1966 (Sources: Lumber production in the Unit States 1799-1946, U.S. Dep. Agr. Misc. Public. 66 1948; Lumber production and mill stocks, Ann Rep. U.S. Dep. Com. Bur. Census, Annu. Report 1947, 1949, 1954, 1958, 1960-66).

6 was hardwood, and more than one-quarter of it s red oak (includes black oak). Other species from ich large amounts of lumber were sawn are white k, hard maple, yellow-poplar, soft maple, and lnut. In 1949, 1,100 sawmills were operating in diana but by 1966 the number of active mills dwindled to 480.

Sixteen counties — Crawford, Decatur, Dubois, khart, Fountain, Jackson, La Grange, La Porte, wrence, Morgan, Noble, Orange, Perry, Putnam, pley, and Sullivan — each produced more than 5 llion board feet of lumber in 1966 and together counted for 47 percent of all lumber production.

ulpwood Harvest Shows Rapid Gain Since 1949

The harvest of round pulpwood from growing ock was second in volume only to the harvest of w logs and bolts in 1966 (fig. 15). The 94 thousand ords of round pulpwood cut in 1966 is a big inrease over the 9 thousand cords cut in 1949, alhough pulpwood cut has remained fairly constant since 1962 when 87 thousand cords were harvested. Most of the 1966 harvest was used in Indiana, but some of it was used by pulpmills in Illinois, Michigan and Ohio. In addition to round pulpwood, a small amount of hardwood sawmill residues was pulped.



igure 15. — Comparison of 1949 and 1966 growing-stock volume cut for products.

Indiana's two pulpmills have a daily capacity of 370 tons[10] of semichemical pulp, which is used primarily for corrugated paper. Part of their wood came from Illinois and Kentucky in 1966. Because the possibilities for pulping hardwoods have greatly expanded, Indiana's pulpwood cut will probably grow rapidly in the future.

Veneer-Log Output Rises

Indiana's 1966 veneer-log output of 16.3 million board feet led all the Central States[11] and constituted 43 percent of their production. The Indiana output was up 40 percent from that of 1949. Forty-two percent of the 1966 veneer-log volume was black walnut and 15 percent was yellow-poplar. The bulk (88 percent) of the volume was used for face and commercial grade veneers, and the remainder for container veneer. The majority of veneer logs cut, therefore, were of high quality and high value. Veneer logs represented one-fourth of the value (at local delivery points) of all timber products cut in 1966, even though veneer-log volume was only 4 percent of the total output.

The 21 veneer mills in Indiana are located principally in the central and southern portions of the State. In 1966 they received 34 million board feet of logs, of which only 14 million board feet were harvested in Indiana. Other states, largely those surrounding Indiana, provided the rest of the veneer logs, except for about a half million board feet that came from Canada, South America, and Africa.

Because of increased competition from paper and plastic, the number of container veneer mills dropped from seven in 1949 to only three in 1966. The number of utility and face-veneer mills was the same in 1966 as in 1949 (18), although there may have been fluctuations in intervening years. Opportunities for expanding veneer production are limited by the shortage of veneer-grade logs in Indiana's standing timber.

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[10] *Source: Lockwood Trade Journal Co. Inc., Lockwood's Directory of the Paper and Allied Trades — 1968, 1704 p. 1967.*

[11] *Central States include Indiana, Iowa, Illinois, and Missouri in this report.*

Production of Cooperage Logs Declines, Handle Logs Stabilizes

Cooperage-log output has been declining since it reached a peak of 6.9 million board feet in 1960. Output in 1962 was 6.2 million board feet, and by 1966 it had dropped to 5.3 million board feet. The cooperage industry is sustained by a law that prohibits reuse of barrels for aging bourbon whiskey. The seven active cooperage mills in the State cut 5.8 million board feet of bolts in 1966. This was down from the 7.0 million board feet cut in 1962, but more than double the volume cut in 1952.

The 1966 handle-log and-bolt harvest was 3.3 million board feet, slightly below the 1962 cut. Practically all of this volume was used by Indiana tool handle plants. In becoming the leading consumer of handle logs and bolts among the Central States, Indiana's four handle plants used 5.6 million board feet of material in 1966. This was 1.5 million board feet more than seven plants consumed in 1962. Ash accounted for half the volume, and hickory and hard maple made up the rest.

Large Declines In Use of Fuelwood, Posts, and Mine Timbers

Important changes in the needs of rural dwelle over the last 20 years have sharply curtailed the pr duction and use of fuelwood and posts in India and all across the Nation. In 1949 fuelwood led a other timber products in volume of roundwood c in the State, with 27.6 million cubic feet. In 19 the cut was only 5.5 million cubic feet. Post produ tion fell even more rapidly — from more than 4 m lion posts cut in 1949 to only 200,000 in 1966.

The extensive shift from underground to strip co mining in Indiana was largely responsible for t decline in mine timber production from 800 thousa cubic feet in 1949 to 100 thousand cubic feet in 196

Roundwood cut for miscellaneous products, most particleboard bolts, rose to 2.7 million cubic feet 1966, a 50 percent increase over the 1949 harvest. I addition, 3.7 million cubic feet of plant residue w used for livestock bedding, mulch, small dimensi stock, and specialty items.

THE FUTURE TIMBER RESOURCE

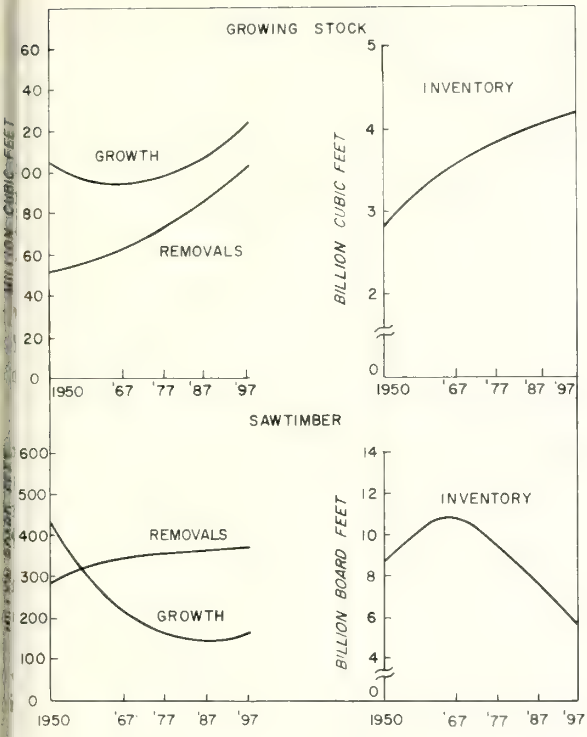
Growth and Removals Projected To Rise

A 30-year projection finds Indiana's growing-stock removals and net growth closer together in 1997 than in 1966, but sawtimber removals and net growth farther apart (fig. 16).

Projections are useful because they provide a look at what might logically happen to the timber resource in light of present and expected levels of growth, removals, stand conditions, and commercial forest land area. Management of a long-lived crop, such as timber, requires a long-range view of the resource. However, the assumptions used in making any projection may not hold true for long in a fast-changing world like ours. Therefore, the projections presented here will probably be most useful in evaluating the timber situation over the next decade.

Growing-stock removals are projected at 102 million cubic feet in 1997, up 58 percent from the 65 million cubic feet removed in 1966. Growth o growing stock, which is presently substantially high than removals, is projected to remain higher and t nearly parallel removals during the last decade the projection period. Net growth is expected to i crease from 95 million cubic feet in 1966 to 12 million cubic feet in 1997. The continuing surpl of growth over removals will build the inventory growing stock, but the rate of increase will less over time. When the level of utilization increases t the point where growth and removals remain equa inventory will stabilize.

Although this projection shows an increase i growing-stock volume over the next 30 years, th forest is capable of producing much more. Grow averaged 24 cubic feet per acre in 1966 — 2 cub feet less than in 1950. The growth in both these yea was less than half of the present growth capacity the forest. As mentioned earlier, approximately tw thirds of the commercial forest area is capable



gure 16. — Removals, net growth, and inventory of growing stock and sawtimber in Indiana, 1950 and 1967, and projections for 1977-1997. (Timber removals in 1950 were adjusted to make them comparabel with timber removals for later years.)

oducing between 50 and 85 cubic feet of wood per re per year at present management levels and full cking. And yields might be pushed even higher rough fertilization and genetic improvement.

The sawtimber inventory, which increased between 50 and 1967, is projected to drop to about half 1967 level at the end of 30 years. Board-foot owth per acre in 1966 was about half of what it is in 1950, largely due to repeated high-grading sawtimber stands. Growth on sawtimber trees, hich amounted to only about two-thirds of sawmber removals in 1966, is expected to decline furter until the last decade of the projection period, hen it may increase. The continuing excess of wtimber removals over growth and resultant big cline of sawtimber inventory projected ahead are atters for concern.

For purposes of projection it was assumed that the ea of commercial forest land in Indiana will decline om 3.9 million acres in 1967 to about 3.0 million res in 1997. Other assumptions used in making the ove projections are found in a footnote to table 62 the Appendix.

Removal of Allowable Cut Would Improve Growth

In contrast to the above picture of what could happen to the forest resource if present trends continue, it may be useful to consider the kind of management that would lead to a more productive forest. If the growth potential of the forest land is to be realized, the many defective, slow-growing stands will have to be replaced by young, vigorous stands. There are an estimated 857,000 acres of commercial forest in need of harvest cutting over the next 10 years, many of which support stands that are past peak productivity. The area suggested for harvest cutting annually during the next decade by forest-type group is as follows:

Forest-type group	*Annual area of harvest cut* (acres)
Pine	700
Upland hardwoods	68,079
Lowland hardwoods	16,942
Total	85,721

In addition to this area, the annual allowable cut figures discussed in the following paragraphs already include the volume from intermediate cuts on about 2,100 acres per year. This is the area estimated in need of thinning annually to reduce stocking of overstocked stands to desirable levels; it is not a measure of total stand improvement work that could be done in the State.

The annual allowable cut for Indiana's commercial forest between 1967 and 1976 is estimated to be 116 million cubic feet, including 421 million board feet in sawtimber trees. As mentioned earlier, the 1966 timber removals of 65 million cubic feet of growing stock and 345 million board feet of sawtimber fall short of the allowable amount. The greatest imbalance between allowable cut and actual removals is in the poletimber portion of growing stock. With the exception of cottonwood and black walnut, most major species can sustain heavier growing-stock removals (fig. 17). Sawtimber harvest of these two species and yellow-poplar also exceeded allowable cut, although the reverse was true for most other species.

If the full allowable cut of growing stock were removed annually beginning in 1967, projections show that growing-stock inventory might decline slightly for the first decade and then climb sharply, as the accelerating growth exceeded removals (fig. 18). By about 1983 inventory would probably be back to its 1967 level, at which time inventory could be

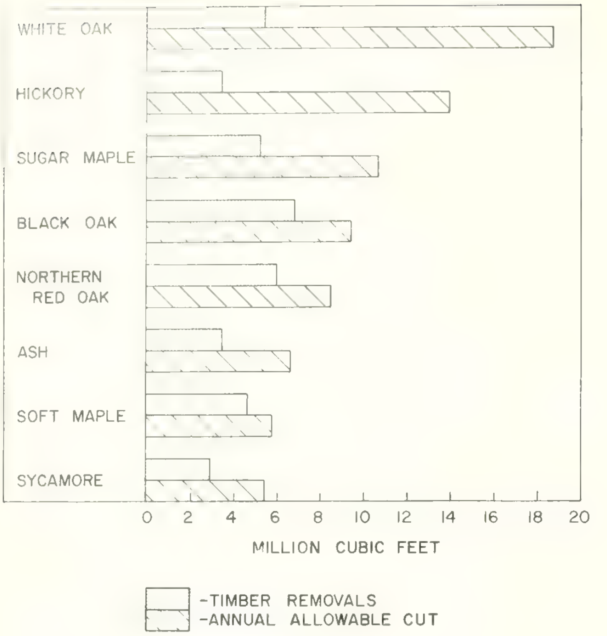


Figure 17. — Comparison of growing-stock timber removals and annual allowable cut for some major species in Indiana, 1966.

stabilized by raising removals to equal growth, or increased by holding removals below growth.

The sawtimber allowable cut, which is nearly double present growth, is recommended for only

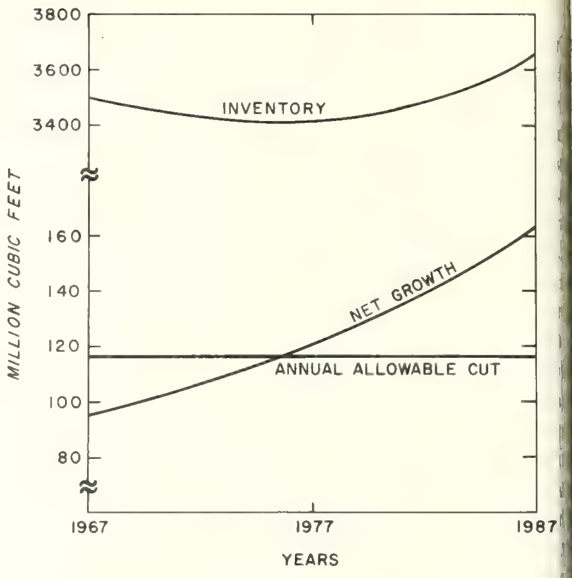


Figure 18. — Projections of growing-stock volu and growth, assuming the recommended allowa cut is removed.

the next decade. If the full allowable cut w removed during each of the next 10 years, it wo have to be reduced in 1977 to around the level removals reported in 1966 (345 million board fe in order to prevent depleting stocking in the la diameter classes. A relatively high initial cut is sirable to harvest stands that are beyond rotation a

OUTLOOK

The projections presented in the preceding section afford a broad look into the possible future of Indiana's timber resource. This section of the report focuses on some of the specific changes that might take place during the next three decades.

Black walnut will undoubtedly be managed much more intensively than ever before. Demand for large-diameter, high-quality walnut veneer and saw logs both nationally and in Indiana, is high and will go higher as the supply continues to dwindle. Indiana's black walnut, which makes up 7 percent of the Nation's total black walnut sawtimber volume, is largely owned by farmers and is found mostly as occasional trees in hardwood stands, pastures, and along fence rows.

In the past, black walnut management consisted primarily of harvesting high-grade, old growth trees. But today enough is known about walnut culture to suggest that landowners investing in selected trees good sites or in walnut orchards might realize reas able returns from growing these trees. Because f grown walnut wood is equal or superior in machin qualities to slow-grown wood, such intensive cultu practices as pruning, fertilization, and release of in vidual trees are desirable, especially in the ea growth stages.

The Nation's growing need for hardwood saw l augurs well for Indiana's hardwood forests. The of hardwood sawtimber in the northern Uni States, where much of the hardwood volume is fou is projected to triple between 1962 and 200

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[12] *Source: U.S.D.A. Forest Service. Tim trends in the United States. Forest Resource R 17, 235 p. 1965.*

portunities to market hardwood logs in Indiana uld improve — especially for high-quality logs. wever high-quality trees will be in increasingly high nand but in short supply unless timber stand im- vement work, which has been largely ignored to te, is undertaken widely. At present there is little suggest that private individuals, who own most Indiana's commercial forest, will be more inclined invest in cultural work in the future than they re in the past.

Some reason for optimism, however, is offered by improved pulping technology that now permits of short-fibered hardwoods for pulpwood. A grow- market now exists for the poor-quality and excess all - diameter hardwood trees present in many nds, should landowners wish to make commercial nnings. Past experience in other parts of the coun- , however, indicates that many landowners take vantage of such new markets by clearing pole- nber stands and selling the trees as pulpwood.

The use of wood chips seems assured of increasing, evidenced by the installation of debarkers and ippers at even small sawmills in the State. In the ture much of the chipping will probably be done the woods with a new generation of mechanized uipment.

Continuing urban spread will force a changing pat- n of land use. Many farm woodlots near expanding ies and towns will be converted to home lots, opping centers, and other developments. Forest creation is likely to increase in importance, espe- lly in southern Indiana. Almost certainly forest landowners will pay increasing attention to the land's esthetic values, especially on lands devoted to recreation (fig. 19).

Forest landowners who desire further information on forest management or marketing of forest products may contact the Indiana Division of Forestry, 613 State Office Building, Indianapolis, Indiana 46204; the local County Extension Agent; or the U.S.D.A. Forest Service, State and Private Forestry, 6816 Market Street, Upper Darby, Pennsylvania 19082.

Figure 19. — Townsend Lake fishing pond on the Hoosier National Forest in Lawrence County, Indiana. Water and forests are two important ingredients in the accelerating boom in outdoor recreation in Indiana and throughout the Nation.

APPENDIX

Accuracy of Survey

The forest area and timber inventory estimates in this report are based on a carefully designed sample of Indiana's forests. Since neither every acre nor every tree in the State was measured, the reported figures are best estimates. A measure of the reliability of these estimates is given by a sampling error. Following is an example of how sampling error is used.

The estimated area of commercial forest land in Indiana in 1967, 3,895.8 thousand acres, has a sampling error of ± 2.02 percent (78.7 thousand acres). If there were no errors in procedure, the odds are 2 to 1 that if we repeated the survey in the same way, the new estimate would be between 3,974.5 and 3,817.1 thousand acres (3,895.8 ± 78.7). Similarly, the odds are 19 to 1 that it would be within ± 157.4 thousand acres (78.7 x 2) of the present estimate.

Likewise, the sampling error for total volume of growing stock in Indiana is ± 3.08 percent; sampling error for net annual growth on growing stock is ± 5.58 percent; and sampling error for volume of timber cut from growing stock is ± 10.20 percent.

In addition, the resource statistics are subject to human errors (mistakes in judgment, recording, calculation, and compilation). These errors are minimized through close supervision and careful training of employees and by rechecking all phases of the work.

As area, volume, growth, and cut figures are broken down by county, forest type, species, ownership, and diameter classes, sampling errors increase — the smaller the unit the higher the sampling error. The following guide may be used in approximating the sampling error for smaller units of measure:

Sampling error (Percent)	*Commercial forest land* (Thousand acres)	*Cubic-foot volume* (Million cu. ft.)	*Cubic-foot growth* (Million cu. ft.)	*Cubic-foot timber cut* (Million cu. ft.)
2	3,974	......	......	......
3	1,766	3,692	......	......
4	994	2,077	......	......
5	636	1,329	118	......
10	159	332	30	60
15	71	148	13	27
20	40	83	7	15
25	25	53	5	10
50	6	13	1	2
100	2	3	(1)	1

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[1] *Less than 500,000 cubic feet.*

Survey Procedure

Area, Volume, and Growth

A total of 178,516 points on aerial photos repr senting a systematic sample of all lands in India was observed. These points were classified as eith forest land (35,653 points) or nonforest la (142,863) points) in order to make a prelimina estimate of forest area. Of the forest points, 11,7 were stereo-classified by county as to forest typ stand-size class, and density. A total of 1,226 poin classed as forest land and 4,727 points classed nonforest land was examined on the ground to co rect for errors in classification and for actual chang in land use since the photos were taken. At each the 1,020 commercial forest land locations, 10 va able-radius plots (37.5 basal area factor) we established uniformly over a sample acre. Measur ments taken were used to compute volume an growth estimates. Each of these locations was car fully marked for remeasurement during the ne survey.

Timber Cut

Timber-cut estimates for 1966 were obtained canvassing all sawmills, veneer mills, pulpmills a other wood-using industries in Indiana. The cut fuelwood and fence posts was estimated using 19 Bureau of Census data.

Allowable Cut

Allowable cut is the volume of timber on comme cial forest land that could be cut annually for t next 10 years, while improving tree stocking a bringing about a more even distribution of a classes. It includes one-tenth of the volume in stan that would reach or exceed rotation age during t next 10 years. It also includes stand-improveme cuts (partial cuts) in young pole or sawtimber stan Stands selected for harvest cuts or cultural operatio had to have a yield of at least 3 cords per acre to included in the allowable cut.

Allowable cut is based on the assumptions that timber will be available and accessible when neede and that a ready market will exist for every speci size, and grade of material harvested. Further, assumes that the proper sequence of cutting is know and will be followed, and that logging practices e ployed will result in an improved forest. Becau iere is no way of guaranteeing that these assump- ons will be valid over the next 10 years, the allow- ble cut estimates should be compared with timber emovals figures only in a general way.

Comparisons Between Surveys

To evaluate the condition and trend of the forest esource, it is useful to compare the current inven- ory with data from the previous inventory. For the omparison to be valid, however, procedures and defi- itions for each inventory must be consistent. For xample, the use of different volume tables in suc- essive surveys could result in totally irrelevant con- lusions about the trend between surveys.

To make a consistency check, we add to the pre- ious inventory volume the net growth that has ccrued, and subtract the timber removals that oc- urred between surveys. The resulting volume should e close to the inventory volume calculated from the ew survey data. Such a check of growing-stock olumes in Indiana produced satisfactory results. Iowever, sawtimber inventory, growth, and mortal- ty were not consistent.

An analysis of the board foot-cubic foot ratios ised for the two surveys shows them to be significant- y different. This does not imply that the first inven- ory is incorrect or invalid. The first inventory was is reliable as possible using the procedures available n 1950. The second inventory was based on newer ind better procedures, and is therefore the most accu- ate. *For comparison purposes only,* adjustments of 1950 sawtimber inventory, growth and mortality olumes were necessary.

The adjustments were made by multiplying board oot-cubic foot ratios from the 1967 survey times the 1950 cubic-foot volumes of sawtimber trees. This re- sulted in a change of 1950 sawtimber volume from 11,010 million board feet (as published) to 8,736 million board feet. By applying the initial growth rate to the adjusted inventory volume, the 1950 vol- ume of net growth on sawtimber trees was adjusted from 551 to 436 million board feet. Similarly, 1950 sawtimber mortality volume was adjusted from 19 to 15 million board feet by multiplying the initial mortality rate times the adjusted inventory volume. The above adjusted volumes are used whenever comparisons between surveys are made in this report.

Definition of Terms

Land-Use Classes

Gross area. — The entire area of land and water as determined by the Bureau of Census, 1960.

Land area. — The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than one-eighth mile wide, lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of the Census, 1960.

Forest land. — Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet in width.

Commercial forest land. — Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Includes accessible and inaccessible areas suitable for growing crops of industrial wood generally exceeding 20 cubic feet per acre of annual growth.

Noncommercial forest land. — (a) Unproductive — forest land incapable of yielding crops of industrial wood because of adverse site conditions. (b) Productive-reserved — productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Nonforest land. — Land that has never supported forests, and lands formerly forested where forest use is now precluded by development for nonforest-uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National Forest. — Federal lands that have been designated as National Forests or purchase units, and other lands under the administration of the Forest Service.

Miscellaneous Federal. — Lands owned or administrated by the Federal Government.

State, county, and municipal. — Lands owned by states, counties, or municipalities, or lands leased by them for more than 50 years.

Forest industry. — Lands owned by companies or individuals operating wood-using plants.

Farmer-owned. — Lands owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually or, if less than 10 acres, the yield must be at least $250 annually.

Miscellaneous private. — Privately owned lands other than forest-industry or farmer-owned.

Stand-Size Classes

Sawtimber stands. — Stands at least 10 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands. — Stands at least 10 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands. — Stands at least 10 percent stocked with growing-stock trees and with sapling and/or seedlings comprising more than half of the stocking.

Nonstocked land. — Commercial forest land less than 10 percent stocked with growing-stock trees.

Stocking

The degree of occupancy of land by trees, measured in terms of basal area and/or the number of trees required to utilize fully the growth potential of the land. The actual stocking at a point was evaluated against a stocking standard of 80 square feet of basal area per acre for trees 5.0 inches d.b.h. and larger, or its equivalent in numbers of trees per acre for seedlings and saplings.

Forest-Type Groups

Loblolly-shortleaf pine. — Forests in which loblolly, shortleaf, and Virginia pines, singly or in combination, comprise a plurality of the stocking. In Indiana this type occurs principally as plantations of shortleaf and loblolly pine and as natural stands of Virginia pine. (Common associates include gum, hickory, sassafras, and yellow-poplar.) The small area of the white-red-jack pine type has been combined in this report with the loblolly-shortleaf type. The former includes forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprise plurality of the stocking. (Common associates inclu hemlock, aspen, birch, and maple.)

Oak-pine. — Forests in which hardwoods (usua upland oaks) comprise a plurality of the stocki but in which southern pines comprise 25 to 50 p cent of the stocking. (Common associates inclu gum, hickory, sassafras, and yellow-poplar.)

Oak-hickory. — Forests in which upland oaks hickory, singly or in combination, comprise a pl ality of the stocking except where pines comprise to 50 percent, in which case the stand would classified oak-pine. (Common associates include y low-poplar, elm, maple, black walnut, black locu and catalpa.)

Oak-gum-cypress. — Bottomland forests in whi tupelo, blackgum, sweetgum, oaks, or southern press, singly or in combination, comprise a plural of the stocking except where pines comprise 25 50 percent, in which case the stand would be clas fied oak-pine. (Common associates includes cotto wood, willow, ash, elm, hackberry, and maple.)

Elm-ash-cottonwood. — Lowland forests in whi elm, ash, cottonwood, or soft maple, singly or in co bination, comprise a plurality of the stocking. (Co mon associates include willow, sycamore, and beech

Maple - beech - birch. — Upland forests in whi hard maple or beech, singly or in combination, co prise a plurality of the stocking. (Common associa include elm, basswood, and soft maple.)

Aspen-birch. — Forests in which aspen, balsa poplar, paper birch, or gray birch, singly or in co bination, comprise a plurality of the stocking. (Co mon associate is soft maple.)

Site-Quality Classes

A classification of forest land in terms of inhere capacity to grow crops of industrial wood based fully stocked natural stands. Five site-quality clas were used — sites capable of producing the followi cubic-foot volumes of wood annually:

165+
120 to 165
85 to 120
50 to 85
20 to 50

Site Index

An expression of forest site quality based on t height of free-growing dominant or codominant tre of a representative species in the forest type at a 50.

nd Age

Age of the main stand.

ea Condition Classes

Classification of commercial forest land based on
cking of desirable trees and other cover conditions
ecting current and prospective timber growth.

Class 10. — Areas 100 percent or more stocked
h desirable trees but not overstocked. Stands do
require immediate treatment to maintain a high
el of growth.

Class 20. — Areas 100 percent or more stocked
h desirable trees, but overstocked with all live
es. Stands require thinning to produce maximum
owth of desirable trees.

Class 30. — Areas 60 to 100 percent stocked with
sirable trees, and with less than 30 percent of the
a controlled by acceptable growing-stock trees,
l trees, inhibiting vegetation, slash, or nonstockable
nditions. Stands have conditions favorable for nat-
al improvement of stocking without special treat-
nt.

Class 40. — Area 60 to 100 percent stocked with
sirable trees and with 30 percent or more of the
a controlled by other trees or conditions that pre-
nt occupancy by desirable trees. Stands need spe-
l treatment such as thinning or cull-tree removal
improve desirable-tree stocking.

Class 50. — Area less than 60 percent stocked with
sirable trees, but 100 percent or more stocked with
owing-stock trees. Stands need special treatment to
prove desirable-tree stocking. Stands that have al-
ost reached rotation age would usually not be
ated.

Class 60. — Areas less than 60 percent stocked with
sirable trees, but 60 to 100 percent stocked with
owing-stock trees. Stands need special treatment to
prove desirable-tree stocking.

Class 70. — Areas less than 60 percent stocked with
sirable trees and less than 60 percent stocked with
owing-stock trees. Stands need treatment to im-
ove desirable-tree or growing-stock tree stocking.

ee Classes

Growing-stock trees. — Sawtimber trees, poletimber
ees, saplings and seedlings. That is, all live trees ex-
pt rough and rotten trees.

Desirable trees. — Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest management in silvicultural operations.

Acceptable trees. — Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees. — Live trees of commercial species containing at least a 12-foot saw log. Softwoods must be at least 9.0 inches in diameter at breast height and hardwoods at least 11.0 inches.

Poletimber trees. — Live trees of commercial species at least 5.0 inches in diameter at breast height but smaller than sawtimber size, and of good form and vigor.

Saplings. — Live trees of commercial species 1.0 to 5.0 inches in diameter at breast height and of good form and vigor.

Seedlings. — Live trees of commercial species less than 1.0 inch in diameter at breast height that are expected to survive according to regional standards.

Rough trees. — Live trees that do not contain at least one merchantable 12-foot saw log, now or prospectively, because of roughness, poor form, or noncommercial species.

Rotten trees. — Live trees of commercial species that do not contain a merchantable 12-foot saw log, now or prospectively, because of rot.

Short-log trees (rough trees). — Trees that contain one or more 8- to 11-foot saw logs that would qualify as growing stock except for the 12-foot log requirement. The net volume of these trees is shown separately from growing stock.

Diameters

Diameter at breast height (d.b.h.). — Tree diameter in inches, outside bark, measured at 4½ feet above ground.

Diameter classes. — The 2-inch diameter classes extend from 1.0 inch below to 0.9 inch above the stated midpoint. For example, the 6-inch class contains trees 5.0 to 6.9 inches d.b.h.

Timber Volume

Volume of growing stock. — The volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet but may be converted into solid-wood cords by dividing by 79.

Volume of sawtimber. — Net volume of the saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion. — That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Quality Classes

Log grade. — Classification of logs based on external characteristics as indicators of quality. Hardwood species were graded in accordance with "Hardwood Log Grades for Standard Lumber," issued by the Forest Products Laboratory under the designation D 1737, 1953, and Forest Service standards for hardwood tie and timber logs. Shortleaf, loblolly, and other yellow pines were graded in accordance with "1953 Interim Log Grades for Southern Pine," October 1953, U.S.D.A. Forest Service. All other softwoods were graded in accordance with "Specifications for Log Grades of Hardwoods and Softwoods," Northern Hemlock and Hardwood Association, 1947.

Growth

Net annual growth of growing stock. — The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of t entering these classes through ingrowth, less vol losses resulting from natural causes.

Net annual growth of sawtimber. — The an change in volume of live sawtimber trees and total volume of trees reaching sawtimber size, volume losses resulting from natural causes.

Mortality of growing stock. — The volume of so wood in live sawtimber and poletimber trees d annually from natural causes. Natural causes incl fire, insects, disease, animal damage, weather, suppression.

Mortality of sawtimber. — The net board-foot ume of sawtimber trees dying annually from nat causes.

Timber Removals

Timber removals include (1) the volume of so wood in growing-stock trees harvested for forest p ucts, (2) the logging residues resulting from har ing, and (3) other removals.

Logging residues are the unused portions of gr ing-stock trees cut or killed by logging. Other rem als consist of growing-stock trees removed by cult operations such as stand improvement, and by l clearing and changes in land use.

Timber products output. — All timber prod cut from roundwood, and byproducts of wood-m ufacturing plants. Roundwood products include l bolts, or other round sections cut from grow stock trees, cull trees, salvable dead trees, tree noncommercial species, sapling-size trees, and li wood on forest and nonforest land.

Principal Tree Species of Indiana[13]

SOFTWOOD SPECIES

Shortleaf and loblolly pine:	
Shortleaf pine	*Pinus echinata*
Other yellow pines:	
Virginia pine	*Pinus virginiana*
Eastern white and red pine group:	
Red pine	*Pinus resinosa*
White Pine	*Pinus strobus*
Baldcypress	*Taxodium distichum*
Other eastern softwood group:	
Eastern redcedar	*Juniperus virginiana*
Tamarack	*Larix laricina*
Scotch pine	*Pinus sylvestris*

HARDWOOD SPECIES

Select white oaks:	
White oak	*Quercus alba*
Other select white oak group:	
Swamp white oak	*Quercus bicolor*
Bur oak	*Quercus macrocarpa*
Swamp chestnut oak	*Quercus michauxii*
Chinkapin oak	*Quercus muehlenbergii*
Select red oaks:	
Northern red oak	*Quercus rubra*
Other select red oak group:	
Cherrybark oak	*Quercus falcata* var. *pagodaefolia*
Shumard oak	*Quercus shumardii*
Other white oak group:	
Chestnut oak	*Quercus prinus*
Post oak	*Quercus stellata*
Other red oaks:	
Black oak	*Quercus velutina*
Other red oak group:	
Scarlet oak	*Quercus coccinea*
Southern red oak	*Quercus falcata*
Shingle oak	*Quercus imbricaria*
Pin oak	*Quercus palustris*
Hickory group:	
Mockernut hickory	*Carya tomentosa*
Shagbark hickory	*Carya ovata*
Shellbark hickory	*Carya laciniosa*
Pecan	*Carya illinoensis*
Pignut hickory	*Carya glabra*
Bitternut hickory	*Carya cordiformis*
Hard maple	*Acer saccharum*
Soft maple group:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Boxelder	*Acer negundo*
Beech	*Fagus grandifolia*
Sweetgum	*Liquidambar styraciflua*
Tupelo and blackgum:	
Swamp tupelo	*Nyssa sylvatica* var. *biflora*
Ash group:	
White ash	*Fraxinus americana*
Black ash	*Fraxinus nigra*
Green ash	*Fraxinus pennsylvanica*
Blue ash	*Fraxinus quadrangulata*
Cottonwood and aspen:	
Cottonwood	*Populus deltoides*
Aspen group:	
Balsam poplar	*Populus balsamifera*
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
American basswood	*Tilia americana*
Yellow-poplar	*Liriodendron tulipifera*
Black walnut	*Juglans nigra*
Black cherry	*Prunus serotina*
Elm group:	
Winged elm	*Ulmus alata*
American elm	*Ulmus americana*
Siberian elm	*Ulmus pumila*
Slippery elm	*Ulmus rubra*
Rock elm	*Ulmus thomasii*
American sycamore	*Platanus occidentalis*
Other eastern hardwood group:	
Yellow birch	*Betula alleghaniensis*
River birch	*Betula nigra*
Paper birch	*Betula papyrifera*
Ohio buckeye	*Aesculus glabra*
Hackberry	*Celtis occidentalis*
Northern catalpa	*Catalpa speciosa*
Flowering dogwood	*Cornus florida*
Common persimmon	*Diospyros virginiana*
Honeylocust	*Gleditsia triacanthos*
Kentucky coffeetree	*Gymnocladus dioicus*
Butternut	*Juglans cinerea*
Osage-orange	*Maclura pomifera*
Cucumbertree	*Magnolia acuminata*
Black locust	*Robinia pseudoacacia*
Black willow	*Salix nigra*
Sassafras	*Sassafras albidum*

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[13] *The common and scientific names are based on "Check List of Native and Naturalized Trees of the United States (Including Alaska)" by Elbert L. Little, Jr., U.S. Dep. Agr., Agr. Hanb. 41, 472 p. 1953.*

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37. Walnut volume on nonforest land, by diam classes
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Net volume of growing stock and sawtimber on commercial forest land, by counties and kind of material

owth and Removals

Net annual growth and removals of growing stock on commercial forest land, by species
Net annual growth and removals of growing stock on commercial forest land, by ownership classes and by softwoods and hardwoods
Net annual growth and removals of sawtimber on commercial forest land, by species
Net annual growth and removals of sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods
Net annual growth of growing stock on commercial forest land, by species and Forest Survey Units
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Annual timber removals from growing stock on commercial forest land, by items and by softwoods and hardwoods
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ilization

Output of timber products, by source of material and by softwoods and hardwoods
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62. Removals, net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Indiana, 1967, and projections for 1977, 1987, and 1997

Table 3. — *Area by land classes, Indiana, 1967*

Land class	Thousand acres
Forest land:	
Commercial	3,895.8
Productive-reserved	38.5
Unproductive	30.0
Total	3,964.3
Nonforest land:	
Cropland 1/	13,317.2
Pasture and range	3,454.7
Other 2/	2,424.9
Total	19,196.8
Total area 3/	23,161.1

1/ Source: 1964 Census of Agriculture

2/ Includes swampland, industrial and urban areas, other nonforest land, and 72,500 acres, classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

3/ Source: U.S. Bureau of the Census, Land and Water Area of the United States, 1960.

Table 4. — *Area of commercial forest land, by ownership classes and Forest Survey Units, Indiana, 1967*
(Thousand acres)

Ownership class	All units	Lower Wabash	Knobs	Upland Flats	Northern
National Forest	136.6	8.2	128.4	-	-
Other Federal:					
Bureau of Land Management	-	-	-	-	-
Indian	-	-	-	-	-
Miscellaneous Federal	77.3	49.5	7.0	-	20.8
Total other Federal	77.3	49.5	7.0	-	20.8
State	146.0	12.4	120.2	1.0	12.4
County and municipal	1.0	-	-	-	1.0
Forest industry 1/	21.8	1.0	17.7	.3	2.8
Farmer-owned	2,661.4	500.1	1,090.7	314.3	756.3
Miscellaneous private	851.7	265.0	405.2	38.1	143.4
All ownerships	3,895.8	836.2	1,769.2	353.7	936.7

1/ No farmer-owned and miscellaneous private lands were leased to forest industry.

Table 5. — *Area of commercial forest land, by stand-size and ownership classes, Indiana, 1967*
(Thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands	2,036.5	84.3	130.3	11.2	1,810.7
Poletimber stands	865.7	23.1	56.7	5.2	780.7
Sapling and seedling stands	925.3	22.4	37.2	5.4	860.3
Nonstocked areas	68.3	6.8	.1	-	61.4
All classes	3,895.8	136.6	224.3	21.8	3,513.1

Table 6. — *Area of commercial forest land, by stand-volume and ownership classes, Indiana, 1967*
(Thousand acres)

Stand volume per acre 1/ (board feet)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	1,682.4	46.8	94.6	8.9	1,532.1
1,500 to 5,000	1,427.7	74.9	84.8	8.3	1,259.7
More than 5,000	785.7	14.9	44.9	4.6	721.3
All classes	3,895.8	136.6	224.3	21.8	3,513.1

1/ International 1/4-inch rule.

Table 7. — *Area of commercial forest land, by stocking classes based on selected stand components, Indiana, 1967*
(Thousand acres)

Stocking percentage	Stocking classified in terms of--		
	All live trees	Growing-stock trees	Desirable trees
160+	-	-	-
150 to 160	15.0	1.2	-
140 to 150	33.0	4.5	-
130 to 140	170.9	27.2	-
120 to 130	376.8	51.5	-
110 to 120	608.1	197.3	-
100 to 110	688.2	339.8	-
90 to 100	752.5	393.0	-
80 to 90	466.6	537.9	-
70 to 80	322.2	587.4	-
60 to 70	185.1	497.5	3.4
50 to 60	113.3	394.0	12.6
40 to 50	58.1	302.2	84.8
30 to 40	56.7	181.4	152.2
20 to 30	21.8	199.2	368.6
10 to 20	22.5	113.4	565.1
Less than 10	5.0	68.3	2,709.1
All classes	3,895.8	3,895.8	3,895.8

Table 8. — *Area of commercial forest land, by area-condition and ownership classes, Indiana, 1967*
(Thousand acres)

Area-condition class	All ownership	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Class 50 Less than 60% stocked with desirable trees, but 100% or more stocked with growing-stock trees.	621.5	25.0	52.7	4.1	539.7
Class 60 Areas less than 60% stocked with desirable trees, but 60 to 100% stocked with growing-stock trees.	2,015.8	95.1	119.8	12.3	1,788.6
Class 70 Areas less than 60% stocked with desirable trees and less than 60% stocked with growing-stock trees.	1,258.5	16.5	51.8	5.4	1,184.8
All classes	3,895.8	136.6	224.3	21.8	3,513.1

Table 9. — *Area of commercial forest land, by site and ownership classes, Indiana, 1967*
(Thousand acres)

Site class (cubic feet of growth per acre per year)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
165 or more	8.4	-	-	-	8.4
120 to 165	23.3	-	2.6	0.1	20.6
85 to 120	161.9	1.4	5.5	.7	154.3
50 to 85	2,395.5	52.5	134.7	12.6	2,195.7
Less than 50	1,306.7	82.7	81.5	8.4	1,134.1
All classes	3,895.8	136.6	224.3	21.8	3,513.1

Table 10. — *Area of commercial forest land, by forest types and ownership classes, Indiana, 1967*
(Thousand acres)

Forest type	All ownerships	Public ownerships	Private ownerships
Loblolly-shortleaf pine	54.0	25.1	28.9
Oak-pine	46.0	8.3	37.7
Oak-hickory	2,388.8	270.5	2,118.3
Oak-gum-cypress	52.2	3.2	49.0
Elm-ash-cottonwood	553.7	21.4	532.3
Maple-beech-birch	788.0	32.4	755.6
Aspen-birch	13.1	-	13.1
All types	3,895.8	360.9	3,534.9

Table 11. — *Area of commercial forest land, by forest types and basal area classes, Indiana, 1967*
(Thousand acres)

Forest type	All classes	Basal area class (square feet per acre)									
		0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	180+
Loblolly-shortleaf pine	54.0	10.9	14.7	5.0	6.7	7.6	2.7	6.4	-	-	-
Oak-pine	46.0	13.3	4.7	.5	13.8	9.5	-	4.2	-	-	-
Oak-hickory	2,388.8	187.3	199.2	396.8	718.4	502.2	243.7	131.9	-	9.3	-
Oak-gum-cypress	52.2	6.3	2.0	9.0	11.7	13.7	6.3	.4	-	-	2.8
Elm-ash-cottonwood	553.7	65.3	48.5	125.8	144.9	89.0	50.0	20.5	8.5	1.2	-
Maple-beech-birch	788.0	61.2	68.1	140.6	237.4	146.7	82.5	40.3	3.4	4.4	3.4
Aspen-birch	13.1	2.8	2.0	-	5.3	-	3.0	-	-	-	-
All types	3,895.8	347.1	339.2	677.7	1,138.2	768.7	388.2	203.7	11.9	14.9	6.2

Table 12. — *Area of commercial forest land, by forest types and site index classes, Indiana, 1967*
(Thousand acres)

Forest type	All sites	Site index class (height in feet at 50 years)						
		30-40	40-50	50-60	60-70	70-80	80-90	90-100
Loblolly-shortleaf pine	54.0	-	4.6	4.8	9.8	19.0	3.3	12.5
Oak-pine	46.0	-	16.7	6.3	15.3	4.6	3.1	-
Oak-hickory	2,388.8	15.7	122.6	319.9	552.3	679.6	447.5	251.2
Oak-gum-cypress	52.2	-	5.2	6.5	4.9	20.3	5.6	9.7
Elm ash-cottonwood	553.7	-	3.7	21.5	136.6	138.5	148.1	105.3
Maple-beech-birch	788.0	-	26.1	89.9	192.5	246.2	141.5	91.8
Aspen-birch	13.1	-	-	-	-	2.8	6.0	4.3
All types	3,895.8	15.7	178.9	448.9	911.4	1,111.0	755.1	474.8

Table 13. — *Area of commercial forest land, by forest types, stand-size classes, and Forest Survey Units, Indiana, 1967*
(Thousand acres)

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
All Units					
Loblolly-shortleaf pine	54.0	5.6	20.5	27.9	-
Oak-pine	46.0	7.4	16.4	22.2	-
Oak-hickory	2,388.8	1,233.8	560.6	572.3	22.1
Oak-gum-cypress	52.2	33.2	9.9	9.1	-
Elm-ash-cottonwood	553.7	303.8	102.3	118.2	29.4
Maple-beech-birch	788.0	452.7	147.7	170.8	16.8
Aspen-birch	13.1	-	8.3	4.8	-
All types	3,895.8	2,036.5	865.7	925.3	68.3
Lower Wabash Unit					
Loblolly-shortleaf pine	12.1	-	1.2	10.9	-
Oak-hickory	541.7	304.7	106.1	119.5	11.4
Oak-gum-cypress	14.7	11.0	3.7	-	-
Elm-ash-cottonwood	153.9	82.2	30.0	41.7	-
Maple-beech-birch	106.0	34.3	33.6	38.1	-
Aspen-birch	7.8	-	3.0	4.8	-
All types	836.2	432.2	177.6	215.0	11.4
Knobs Unit					
Loblolly-shortleaf pine	38.6	5.6	17.2	15.8	-
Oak-pine	46.0	7.4	16.4	22.2	-
Oak-hickory	1,262.0	614.8	311.6	335.6	-
Oak-gum-cypress	9.1	7.2	.8	1.1	-
Elm-ash-cottonwood	103.8	70.8	18.8	10.3	3.9
Maple-beech-birch	309.7	195.0	60.3	50.5	3.9
All types	1,769.2	900.8	425.1	435.5	7.8
Upland Flats Unit					
Oak-hickory	183.6	87.0	45.8	44.0	6.8
Oak-gum-cypress	12.7	4.7	-	8.0	-
Elm-ash-cottonwood	55.6	30.9	6.3	13.2	5.2
Maple-beech-birch	101.8	49.8	23.7	20.2	8.1
All types	353.7	172.4	75.8	85.4	20.1
Northern Unit					
Loblolly-shortleaf pine	3.3	-	2.1	1.2	-
Oak-hickory	401.5	227.3	97.1	73.2	3.9
Oak-gum-cypress	15.7	10.3	5.4	-	-
Elm-ash-cottonwood	240.4	119.9	47.2	53.0	20.3
Maple-beech-birch	270.5	173.6	30.1	62.0	4.8
Aspen-birch	5.3	-	5.3	-	-
All types	936.7	531.1	187.2	189.4	29.0

Table 14. — *Area of commercial forest land, by forest types and stand-age classes, Indiana, 1967*
(Thousand acres)

Forest type	All ages	Stand-age class (years)									
		0-40	40-50	50-60	60-70	70-80	80-90	90-100	100-120	120-140	140+
Loblolly-shortleaf pine	54.0	48.3	4.4	-	1.3	-	-	-	-	-	-
Oak-pine	46.0	33.6	2.0	0.5	-	4.2	5.7	-	-	-	-
Oak-hickory	2,388.8	928.5	278.7	180.2	217.4	246.0	137.0	135.9	176.6	68.9	19.6
Oak-gum-cypress	52.2	22.4	5.6	4.9	3.4	-	2.0	3.4	7.7	2.8	-
Elm-ash-cottonwood	553.7	244.8	44.5	39.7	67.9	66.8	72.6	-	17.4	-	-
Maple-beech-birch	788.0	296.8	46.1	63.2	88.7	68.8	89.7	33.1	60.0	29.7	11.9
Aspen-birch	13.1	13.1	-	-	-	-	-	-	-	-	-
All types	3,895.8	1,587.5	381.3	288.5	378.7	385.8	307.0	172.4	261.7	101.4	31.5

Table 15. — *Area of commercial forest land, by forest types and area-condition classes, Indiana, 1967*
(Thousand acres)

Forest type	All area conditions	Class 50	Class 60	Class 70
Loblolly-shortleaf pine	54.0	11.6	23.3	19.1
Oak-pine	46.0	9.1	33.0	3.9
Oak-hickory	2,388.8	459.6	1,282.8	646.4
Oak-gum-cypress	52.2	5.8	25.1	21.3
Elm-ash-cottonwood	553.7	26.6	230.6	296.5
Maple-beech-birch	788.0	105.8	418.0	264.2
Aspen-birch	13.1	3.0	3.0	7.1
All types	3,895.8	621.5	2,015.8	1,258.5

Table 16. — *Area of land and forest land, by counties, Indiana, 1967*

County	All land	Forest land: All forest	Forest land: Non-commercial	Forest land: Commercial	Commercial forest as a percent of land area
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Percent
Adams	220.8	14.3	0.3	14.0	6.3
Allen	429.3	35.6	.3	35.3	8.2
Bartholomew	257.3	35.5	.3	35.2	13.7
Benton	261.8	3.2	.2	3.0	1.1
Blackford	106.9	7.0	.1	6.9	6.4
Boone	273.3	11.5	.4	11.1	4.1
Brown	207.3	148.8	15.5	133.3	64.3
Carroll	239.4	16.2	.2	16.0	6.7
Cass	265.5	20.4	.2	20.2	7.6
Clark	245.8	92.3	.2	92.1	37.5
Clay	233.0	53.3	.3	53.0	22.7
Clinton	260.5	9.9	.4	9.5	3.6
Crawford	199.7	113.4	.6	112.8	56.5
Daviess	275.0	41.9	-	41.9	15.2
Dearborn	195.8	41.7	2.7	39.0	19.9
Decatur	236.7	23.4	.4	23.0	9.7
De Kalb	234.0	22.0	.3	21.7	9.3
Delaware	254.6	11.6	.4	11.2	4.4
Dubois	277.0	96.8	.1	96.7	34.9
Elkhart	299.5	25.7	.3	25.4	8.5
Fayette	137.6	16.3	.5	15.8	11.5
Floyd	95.4	36.8	.2	36.6	38.4
Fountain	254.1	27.1	.6	26.5	10.4
Franklin	252.2	58.2	1.6	56.6	22.4
Fulton	235.4	16.0	.2	15.8	6.7
Gibson	318.9	48.9	-	48.9	15.3
Grant	269.4	14.3	.3	14.0	5.2
Greene	351.4	99.8	.3	99.5	28.3
Hamilton	256.6	13.8	.2	13.6	5.3
Hancock	195.2	9.1	.2	8.9	4.6
Harrison	306.6	131.6	.7	130.9	42.7
Hendricks	266.9	15.6	.3	15.3	5.7
Henry	256.0	14.4	.2	14.2	5.5
Howard	187.5	6.8	.2	6.6	3.5
Huntington	249.6	20.5	.2	20.3	8.1
Jackson	332.8	122.2	.3	121.9	36.6
Jasper	359.7	25.1	.7	24.4	6.8
Jay	217.0	18.9	.3	18.6	7.5
Jefferson	234.2	62.3	1.6	60.7	25.9
Jennings	241.3	68.5	1.0	67.5	28.0
Johnson	201.6	12.5	.3	12.2	6.0
Knox	330.5	39.4	-	39.4	11.9
Kosciusko	345.7	27.8	.3	27.5	8.0
Lagrange	243.8	19.3	.3	19.0	7.8
Lake	328.0	9.7	.2	9.5	2.9
La Porte	388.6	28.3	.3	28.0	7.2
Lawrence	293.8	127.6	2.1	125.5	42.7
Madison	239.9	12.3	.6	11.7	4.0
Marion	256.1	13.7	.3	13.4	5.2
Marshall	283.8	25.4	.3	25.1	8.8
Martin	220.8	111.1	-	111.1	50.3
Miami	243.2	20.4	.2	20.2	8.3
Monroe	262.5	134.5	.7	133.8	51.0
Montgomery	324.5	23.8	2.0	21.8	6.7
Morgan	259.8	92.0	.1	91.9	35.4
Newton	264.3	18.6	.2	18.4	7.0
Noble	263.9	24.3	1.1	23.2	8.8
Ohio	55.7	13.5	.3	13.2	23.7
Orange	259.2	119.2	.8	118.4	45.7
Owen	249.2	115.7	1.9	113.8	45.7
Parke	288.6	92.4	2.4	90.0	31.2
Perry	245.8	143.6	.8	142.8	58.1
Pike	214.4	79.8	-	79.8	37.2
Porter	271.7	27.9	2.3	25.6	9.4
Posey	263.6	42.1	-	42.1	16.0
Pulaski	277.1	27.0	2.8	24.2	8.7
Putnam	313.6	72.2	.7	71.5	22.8
Randolph	292.5	14.7	.6	14.1	4.8
Ripley	282.9	54.6	4.8	49.8	17.6
Rush	261.8	12.5	.2	12.3	4.7
St Joseph	298.4	21.8	.2	21.6	7.2
Scott	123.5	45.2	.1	45.1	36.5
Shelby	261.8	13.5	.5	13.0	5.0
Spencer	253.4	69.6	1.8	67.8	26.8
Starke	198.7	24.7	.3	24.4	12.3
Steuben	198.0	23.6	1.0	22.6	11.4
Sullivan	292.5	54.1	.3	53.8	18.4
Switzerland	111.4	39.3	.5	38.8	27.1
Tippecanoe	319.7	19.2	.4	18.8	5.9
Tipton	167.0	6.4	.1	6.3	3.8
Union	107.5	13.2	.9	12.3	11.4
Vanderburgh	154.3	20.0	-	20.0	13.0
Vermillion	168.3	35.0	-	35.0	20.8
Vigo	265.5	50.2	-	50.2	18.9
Wabash	269.3	21.3	.2	21.1	7.8
Warren	235.5	20.3	.2	20.1	8.5
Warrick	250.2	76.2	.7	75.5	30.2
Washington	330.2	130.6	.3	130.3	39.5
Wayne	259.1	23.3	.2	23.1	8.9
Wells	235.5	17.3	.9	16.4	7.0
White	317.9	12.7	.3	12.4	3.9
Whitley	215.5	20.2	.2	20.0	9.3
All counties	23,161.1	3,961.3	68.5	3,895.8	16.8

Table 17. —*Area of commercial forest land, by counties and stand-size classes, Indiana, 1967*
(Thousand acres)

County	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
Adams	14.0	9.1	2.3	2.3	0.3
Allen	35.3	20.3	7.6	6.3	1.1
Bartholomew	35.2	22.9	5.9	5.9	.5
Benton	3.0	.4	1.1	1.3	.2
Blackford	6.9	4.8	.9	.8	.4
Boone	11.1	4.1	2.1	3.8	1.1
Brown	133.3	80.1	28.8	24.2	.2
Carroll	16.0	8.5	3.6	3.2	.7
Cass	20.2	13.1	3.9	3.0	.2
Clark	92.1	44.8	29.6	17.1	.6
Clay	53.0	26.2	10.0	16.1	.7
Clinton	9.5	5.8	1.2	2.2	.3
Crawford	112.8	48.0	35.6	29.0	.2
Daviess	41.9	22.8	9.4	8.8	.9
Dearborn	39.0	15.5	6.3	12.2	5.0
Decatur	23.0	14.5	4.2	3.7	.6
De Kalb	21.7	12.7	4.5	3.9	.6
Delaware	11.2	7.3	2.2	1.4	.3
DuBois	96.7	56.0	18.5	21.6	.6
Elkhart	25.4	14.2	3.9	6.3	1.0
Fayette	15.8	8.0	3.0	3.6	1.2
Floyd	36.6	21.1	9.1	6.2	.2
Fountain	26.5	17.9	5.4	2.8	.4
Franklin	56.6	29.6	10.8	12.9	3.3
Fulton	15.8	10.3	2.5	2.8	.2
Gibson	48.9	30.3	8.1	9.3	1.2
Grant	14.0	9.3	1.8	2.7	.2
Greene	99.5	46.8	22.3	29.5	.9
Hamilton	13.6	8.6	2.1	2.6	.3
Hancock	8.9	5.6	.8	2.0	.5
Harrison	130.9	64.3	29.7	36.3	.6
Hendricks	15.3	7.6	3.9	3.1	.7
Henry	14.2	8.2	3.2	2.2	.6
Howard	6.6	3.6	1.4	1.4	.2
Huntington	20.3	9.9	5.2	4.4	.8
Jackson	121.9	62.7	27.5	31.1	.6
Jasper	24.4	11.5	6.7	5.3	.9
Jay	18.6	12.9	2.0	2.7	1.0
Jefferson	60.7	30.3	13.6	14.8	2.0
Jennings	67.5	39.6	13.9	11.8	2.2
Johnson	12.2	8.3	2.2	1.4	.3
Knox	39.4	19.4	8.9	9.9	1.2
Kosciusko	27.5	15.7	4.6	5.4	1.8
LaGrange	19.0	9.4	3.6	5.0	1.0
Lake	9.5	5.4	2.0	1.9	.2
La Porte	28.0	13.8	5.9	7.7	.6
Lawrence	125.5	62.2	23.2	39.5	.6
Madison	11.7	6.3	1.4	3.3	.7
Marion	13.4	7.9	2.8	2.5	.2
Marshall	25.1	15.8	3.5	5.2	0.6
Martin	111.1	65.3	23.0	22.5	.3
Miami	20.2	10.7	4.3	4.8	.4
Monroe	133.8	68.7	36.0	28.7	.4
Montgomery	21.8	10.4	7.0	4.1	.3
Morgan	91.9	42.8	26.5	22.0	.6
Newton	18.4	7.6	3.7	6.7	.4
Noble	23.2	12.5	5.4	4.6	.7
Ohio	13.2	5.6	2.5	4.3	.8
Orange	118.4	52.2	29.4	36.4	.4
Owen	113.8	56.9	30.1	26.4	.4
Parke	90.0	45.1	21.6	22.5	.8
Perry	142.8	74.0	40.1	28.3	.4
Pike	79.8	27.2	16.6	35.4	.6
Porter	25.6	13.7	6.7	4.2	1.0
Posey	42.1	25.8	7.1	8.3	.9
Pulaski	24.2	11.0	6.6	6.1	.5
Putnam	71.5	39.5	15.6	15.5	.9
Randolph	14.1	8.1	2.9	2.8	.3
Ripley	49.8	24.9	10.9	11.0	3.0
Rush	12.3	7.7	1.6	2.0	1.0
St. Joseph	21.6	11.7	5.4	3.8	.7
Scott	45.1	25.4	9.7	9.8	.2
Shelby	13.0	8.1	.7	3.6	.6
Spencer	67.8	36.3	11.5	19.4	.6
Starke	24.4	12.7	6.4	4.8	.5
Steuben	22.6	11.7	3.8	6.5	.6
Sullivan	53.8	27.5	13.6	11.8	.9
Switzerland	38.8	12.6	12.1	12.3	1.8
Tippecanoe	18.8	9.9	4.3	4.2	.4
Tipton	6.3	4.2	.5	1.6	-
Union	12.3	6.3	2.7	2.5	.8
Vanderburgh	20.0	11.9	4.1	3.4	.6
Vermillion	35.0	19.2	6.6	8.6	.6
Vigo	50.2	25.2	10.7	13.4	.9
Wabash	21.1	12.6	4.0	3.8	.7
Warren	20.1	11.6	4.5	3.6	.4
Warrick	75.5	25.8	14.4	34.7	.6
Washington	130.3	79.5	25.4	24.8	.6
Wayne	23.1	13.2	4.8	4.5	.6
Wells	16.4	10.7	2.7	2.7	.3
White	12.4	6.5	3.3	2.2	.4
Whitley	20.0	10.8	4.2	4.3	.7
All counties	3,895.8	2,036.5	865.7	925.3	68.3

Table 18. — *Area of commercial forest land, by forest types and counties, Indiana, 1967*
(Thousand acres)

County	All types	Loblolly-shortleaf pine	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch
Adams	14.0	-	-	5.9	0.1	4.9	2.9	0.2
Allen	35.3	0.1	-	13.3	.5	12.3	9.0	.1
Bartholomew	35.2	-	-	16.0	.6	7.4	11.1	.1
Benton	3.0	-	-	.9	.4	1.3	0.4	-
Blackford	6.9	-	-	2.4	-	2.4	2.1	-
Boone	11.1	.2	-	5.3	-	2.8	2.8	-
Brown	133.3	1.6	3.4	102.0	.6	4.2	21.5	-
Carroll	16.0	-	-	7.1	.3	3.9	4.6	.1
Cass	20.2	-	-	8.4	1.1	3.5	7.2	-
Clark	92.1	5.0	2.6	63.7	.5	4.1	16.2	-
Clay	53.0	.4	-	34.8	.9	10.2	6.3	.4
Clinton	9.5	-	-	2.9	.1	3.5	3.0	-
Crawford	112.8	2.4	3.0	87.5	.4	3.9	15.6	-
Daviess	41.9	.4	-	26.3	1.1	9.2	4.4	.5
Dearborn	39.0	-	-	15.7	2.7	7.7	12.9	-
Decatur	23.0	.1	-	9.9	.4	5.3	7.1	.2
De Kalb	21.7	.1	-	7.0	1.0	8.1	5.5	-
Delaware	11.2	-	-	4.4	-	2.8	3.7	.3
Dubois	96.7	2.2	1.9	63.1	1.1	9.8	18.6	-
Elkhart	25.4	-	-	9.5	.5	7.4	8.0	-
Fayette	15.8	-	-	8.0	1.2	2.7	3.9	-
Floyd	36.6	1.0	1.1	27.1	.1	.9	6.4	-
Fountain	26.5	.1	-	11.5	.4	6.3	8.1	.1
Franklin	56.6	-	-	29.0	2.8	9.6	15.2	-
Fulton	15.8	-	-	7.8	.1	3.1	4.8	-
Gibson	48.9	.4	-	26.3	2.0	14.0	6.2	-
Grant	14.0	-	-	5.6	-	3.1	5.3	-
Greene	99.5	2.6	-	72.4	1.5	11.8	11.2	-
Hamilton	13.6	-	-	5.5	-	3.7	4.4	-
Hancock	8.9	-	-	1.6	.3	2.0	5.0	-
Harrison	130.9	5.6	4.5	94.4	.4	6.4	19.6	-
Hendricks	15.3	-	-	6.9	-	5.1	3.0	.3
Henry	14.2	-	-	5.0	-	2.5	6.5	.2
Howard	6.6	.1	-	2.8	-	2.6	1.1	-
Huntington	20.3	.2	-	9.3	.2	6.0	4.5	.1
Jackson	121.9	2.1	2.6	82.5	.9	9.2	24.6	-
Jasper	24.4	.1	-	11.9	1.1	5.6	5.4	.3
Jay	18.6	-	-	7.1	.1	4.4	6.9	.1
Jefferson	60.7	-	-	35.0	1.3	7.2	17.2	-
Jennings	67.5	-	-	36.7	1.6	9.5	19.7	-
Johnson	12.2	-	-	5.8	.1	3.6	2.7	-
Knox	39.4	.4	-	22.4	.5	10.7	5.4	-
Kosciusko	27.5	-	-	11.2	.4	6.9	8.9	.1
La grange	19.0	.1	-	8.2	.2	5.7	4.8	-
Lake	9.5	-	-	4.0	.6	3.3	1.6	-
La Porte	28.0	.5	-	15.6	1.1	5.1	5.4	.3
Lawrence	125.5	1.5	3.2	88.4	.4	10.0	22.0	-
Madison	11.7	-	-	3.4	.1	2.8	5.4	-
Marion	13.4	-	-	5.1	.5	2.3	5.5	-

(Continued on next page)

Table 18 (Continued)

County	All types	Loblolly-shortleaf pine	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch
Marshall	25.1	0.2	-	12.0	0.8	5.5	6.6	-
Martin	111.1	1.7	-	80.6	2.6	11.0	14.8	0.4
Miami	20.2	.4	-	8.7	.2	4.3	6.6	-
Monroe	133.8	1.9	4.5	99.8	.1	4.1	23.4	-
Montgomery	21.8	.2	-	11.8	.2	5.7	3.7	.2
Morgan	91.9	.8	2.4	66.0	1.2	5.4	16.1	-
Newton	18.4	-	-	9.5	.3	4.2	4.3	.1
Noble	23.2	-	-	11.3	.4	4.0	7.1	.4
Ohio	13.2	-	-	5.9	.7	2.7	3.9	-
Orange	118.4	3.4	3.8	79.6	.3	9.9	21.4	-
Owen	113.8	1.0	2.0	85.7	.4	4.5	20.2	-
Parke	90.0	2.2	-	62.7	.7	12.7	11.7	-
Perry	142.8	5.8	3.6	105.7	.7	4.7	22.3	-
Pike	79.8	2.0	-	43.9	.8	19.6	8.6	4.9
Porter	25.6	-	-	11.0	.4	6.8	6.9	.5
Posey	42.1	-	-	25.4	.9	10.6	5.2	-
Pulaski	24.2	-	-	12.3	.3	5.3	6.0	.3
Putnam	71.5	1.2	-	52.9	1.5	8.9	7.0	-
Randolph	14.1	-	-	5.7	.5	3.3	4.5	.1
Ripley	49.8	-	-	25.4	1.6	9.4	13.4	-
Rush	12.3	-	-	3.2	-	4.5	4.5	.1
St. Joseph	21.6	-	-	9.4	.3	5.7	6.2	-
Scott	45.1	.4	.7	32.3	.6	3.2	7.9	-
Shelby	13.0	-	-	3.7	-	4.0	5.3	-
Spencer	67.8	.4	1.3	40.9	.2	9.8	15.2	-
Starke	24.4	-	-	12.3	.9	4.9	5.9	.4
Steuben	22.6	.2	-	9.1	-	5.5	7.5	.3
Sullivan	53.8	-	-	30.4	.5	13.0	8.7	1.2
Switzerland	38.8	-	-	22.1	.3	3.7	12.7	-
Tippecanoe	18.8	.1	-	7.8	.5	4.6	5.7	.1
Tipton	6.3	-	-	2.0	-	2.6	1.7	-
Union	12.3	-	-	5.8	.5	3.1	2.9	-
Vanderburgh	20.0	-	-	12.5	.1	4.6	2.8	-
Vermillion	35.0	-	-	23.1	1.2	5.8	4.9	-
Vigo	50.2	.8	-	28.0	.4	11.8	8.8	.4
Wabash	21.1	.1	-	8.4	.1	6.5	5.9	.1
Warren	20.1	-	-	10.4	-	5.2	4.5	-
Warrick	75.5	1.7	2.3	49.4	.5	8.3	13.3	-
Washington	130.3	1.8	3.1	93.9	.7	5.4	25.4	-
Wayne	23.1	-	-	9.3	.4	6.7	6.5	.2
Wells	16.4	-	-	7.4	-	4.2	4.8	-
White	12.4	-	-	7.0	.1	2.5	2.8	-
Whitley	20.0	.5	-	7.9	.1	4.7	6.8	-
All counties	3,895.8	54.0	46.0	2,388.8	52.2	553.7	788.0	13.1

Table 19. — *Area of noncommercial forest land, by forest types, Indiana, 1967*
(Thousand acres)

Forest type	All areas	Productive reserved areas	Unproductive areas
Loblolly-shortleaf pine	0.5	0.5	-
Oak-pine	-	-	-
Oak-hickory	55.0	28.7	26.3
Oak-gum-cypress	-	-	-
Elm-ash-cottonwood	6.0	2.3	3.7
Maple-beech-birch	7.0	7.0	-
Aspen-birch	-	-	-
All types	68.5	38.5	30.0

Table 20. — *Number of growing-stock trees on commercial forest land, by species and diameter classes, Indiana, 1967*

(Thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
Softwoods:											
Shortleaf and loblolly pine	2,956	1,674	1,021	240	21	-	-	-	-	-	-
Other yellow pines	3,842	1,897	1,218	478	159	69	10	11	-	-	-
Cypress	61	-	-	-	-	-	-	7	-	31	23
Other softwoods	4,569	2,400	1,517	423	158	59	-	12	-	-	-
Total softwoods	11,428	5,971	3,756	1,141	338	128	10	30	-	31	23
Hardwoods:											
White oak	37,746	10,886	8,942	6,151	4,085	3,124	2,053	1,037	661	736	71
Other select white oaks	2,631	650	583	342	224	217	138	109	151	181	36
Select red oak	15,138	3,664	2,657	2,489	1,805	1,684	1,092	581	486	607	73
Other white oaks	9,278	1,905	1,798	1,795	1,457	1,243	623	300	81	71	5
Black oak	20,684	5,411	3,712	3,276	2,703	2,061	1,372	1,008	523	574	44
Other red oaks	6,408	1,448	1,529	985	902	426	386	243	197	272	20
Hickory	47,740	19,158	10,961	7,959	4,282	2,687	1,557	572	296	250	18
Hard maple	29,918	12,724	7,044	3,968	2,413	1,526	1,226	510	248	251	8
Soft maple	11,495	4,706	2,926	1,460	851	674	368	209	109	166	26
Beech	7,008	1,466	1,559	1,005	724	699	525	418	245	329	38
Sweetgum	4,985	1,720	1,646	646	357	301	175	71	33	28	8
Tupelo and blackgum	2,858	857	674	574	320	198	77	70	54	34	-
Ash	23,703	11,005	5,555	2,914	1,877	1,102	722	323	89	114	2
Cottonwood	3,236	828	614	392	448	300	167	117	115	229	26
Aspen	2,906	1,263	653	562	231	135	47	7	8	-	-
Basswood	2,543	913	487	371	199	227	125	110	59	50	2
Yellow-poplar	13,015	3,819	2,658	1,974	1,653	1,397	570	392	261	283	8
Black walnut	8,374	2,793	2,435	1,153	843	645	303	117	72	13	-
Black cherry	6,125	2,562	1,695	905	338	277	250	48	15	35	-
Elm	13,289	5,980	3,564	1,908	978	284	263	153	63	96	-
Sycamore	7,864	2,070	1,685	1,472	780	565	457	255	234	280	66
Other hardwoods	22,995	11,477	5,567	3,025	1,507	703	355	150	118	83	10
Total hardwoods	299,939	107,305	68,944	45,326	28,977	20,475	12,851	6,800	4,118	4,682	461
All species	311,367	113,276	72,700	46,467	29,315	20,603	12,861	6,830	4,118	4,713	484

Table 21. — *Number of growing-stock trees on commercial forest land, by species groups, diameter classes, and Forest Survey Units, Indiana, 1967*

(Thousand trees)

Species group	All classes	Diameter class (inches at breast height)											
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0 and larger
All units														
Softwoods	54,017	27,168	15,421	5,971	3,756	1,141	338	128	10	30	-	8	23	23
Hardwoods	1,002,872	498,770	204,163	107,305	68,944	45,326	28,977	20,475	12,851	6,800	4,118	2,246	2,436	461
All species	1,056,889	525,938	219,584	113,276	72,700	46,467	29,315	20,603	12,861	6,830	4,118	2,254	2,459	484
Lower Wabash Unit														
Softwoods	2,913	1,041	1,145	465	174	27	-	-	-	7	-	8	23	23
Hardwoods	223,643	111,087	42,900	26,683	17,018	9,492	6,121	4,039	2,742	1,540	970	415	541	95
All species	226,556	112,128	44,045	27,148	17,192	9,519	6,121	4,039	2,742	1,547	970	423	564	118
Knobs Unit														
Softwoods	44,098	22,857	11,879	4,564	3,309	1,056	284	128	10	11	-	-	-	-
Hardwoods	510,098	253,667	105,764	51,924	33,533	25,277	15,977	10,983	6,176	3,226	1,624	906	887	154
All species	554,196	276,524	117,643	56,488	36,842	26,333	16,261	11,111	6,186	3,237	1,624	906	887	154
Upland Flats Unit														
Softwoods	2,623	1,541	819	227	33	-	3	-	-	-	-	-	-	-
Hardwoods	53,123	21,686	12,676	7,421	3,928	2,680	1,282	1,455	847	451	301	186	179	31
All species	55,746	23,227	13,495	7,648	3,961	2,680	1,285	1,455	847	451	301	186	179	31
Northern Unit														
Softwoods	4,383	1,729	1,578	715	240	58	51	-	-	12	-	-	-	-
Hardwoods	216,008	112,330	42,823	21,277	14,465	7,877	5,597	3,998	3,086	1,583	1,223	739	829	181
All species	220,391	114,059	44,401	21,992	14,705	7,935	5,648	3,998	3,086	1,595	1,223	739	829	181

Table 22. — *Number of cull trees on commercial forest land, by species and diameter classes, Indiana, 1967*

(Thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
Softwoods:											
Shortleaf and loblolly pine	182	114	42	18	8	-	-	-	-	-	-
Other yellow pines	319	214	54	38	-	7	-	5	1	-	
Cypress	-	-	-	-	-	-	-	-		-	-
Other softwoods	941	622	99	86	100	28	-	-	6	-	-
Total softwoods	1,442	950	195	142	108	35	-	5	7	-	-
Hardwoods:											
White oak	3,795	1,511	449	407	448	255	149	159	115	205	97
Other select white oaks	355	195	-	-	60	12	23	19	11	27	8
Select red oak	1,155	246	231	160	90	122	70	61	33	99	43
Other white oaks	516	141	32	53	73	117	53	7	35	5	-
Black oak	2,636	650	253	398	289	247	273	161	126	183	56
Other red oaks	1,267	638	108	177	121	97	46	32	26	18	4
Hickory	4,035	1,780	705	429	470	283	152	79	59	74	4
Hard maple	5,093	879	1,092	699	645	556	402	258	159	361	42
Soft maple	5,349	2,012	1,345	619	541	215	191	136	83	150	57
Beech	4,226	1,074	715	533	347	89	246	314	144	614	150
Sweetgum	943	558	197	63	66	-	23	10	16	10	-
Tupelo and blackgum	501	191	66	94	57	35	34	18	-	6	-
Ash	3,630	1,745	703	370	388	195	79	43	26	77	4
Cottonwood	556	114	231	74	61	28	-	17	8	15	8
Aspen	546	467	49	-	21	-	-	9	-	-	-
Basswood	471	-	56	47	85	53	93	19	43	63	12
Yellow-poplar	1,073	521	79	79	154	46	35	49	6	79	25
Black walnut	2,140	726	414	367	337	93	85	72	23	23	-
Black cherry	3,247	1,685	669	392	172	210	38	41	33	7	-
Elm	5,188	2,499	1,549	569	232	95	101	81	37	24	1
Sycamore	1,068	140	362	95	48	140	64	74	57	62	26
Other hardwoods	13,421	7,928	2,084	1,555	833	474	259	114	42	110	22
Noncommercial species	5,129	4,106	747	157	60	15	36	-	8	-	-
Total hardwoods	66,340	29,806	12,136	7,337	5,598	3,377	2,452	1,773	1,090	2,212	559
All species	67,782	30,756	12,331	7,479	5,706	3,412	2,452	1,778	1,097	2,212	559

Table 23. — *Number of short-log trees on commercial forest land, by species and diameter classes, Indiana, 1967*
(Thousand trees)

Species	Diameter class (inches at breast height)									
	All diameters	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0 and larger
Softwoods:										
Shortleaf and loblolly pine	13	5	8	-	-	-	-	-	-	-
Other yellow pines	1	-	-	-	-	-	1	-	-	-
Cypress	-	-	-	-	-	-	-	-	-	-
Other softwoods	11	11	-	-	-	-	-	-	-	-
Total softwoods	25	16	8	-	-	-	1	-	-	-
Hardwoods:										
White oak	574	-	144	139	67	77	41	33	51	22
Other select white oaks	52	-	23	-	-	16	6	-	3	4
Select red oak	185	-	44	46	33	24	-	5	33	-
Other white oaks	80	-	13	53	2	7	5	-	-	-
Black oak	477	-	169	89	68	56	51	22	11	11
Other red oaks	135	-	62	22	22	20	6	-	3	-
Hickory	391	-	164	120	41	30	31	5	-	-
Hard maple	381	-	138	102	46	59	5	14	17	-
Soft maple	282	-	158	71	23	6	9	6	7	2
Beech	204	-	101	10	34	35	10	6	8	-
Sweetgum	28	-	20	-	-	-	4	4	-	-
Tupelo and blackgum	4	-	-	4	-	-	-	-	-	-
Ash	237	-	127	52	28	16	2	5	7	-
Cottonwood	4	-	-	-	-	-	-	-	4	-
Aspen	-	-	-	-	-	-	-	-	-	-
Basswood	36	-	-	-	31	-	-	-	5	-
Yellow-poplar	34	-	24	-	2	-	-	-	8	-
Black walnut	216	-	144	26	25	18	3	-	-	-
Black cherry	95	-	52	43	-	-	-	-	-	-
Elm	106	-	71	7	9	18	-	-	-	1
Sycamore	67	-	4	29	19	6	-	9	-	-
Other hardwoods	181	-	70	59	39	-	-	8	5	-
Total hardwoods	3,769	-	1,528	872	489	388	173	117	162	40
All species	3,794	16	1,536	872	489	388	174	117	162	40

Table 24. — *Net volume of timber on commercial forest land, by class of timber and by softwoods and hardwoods, Indiana, 1967*
(Million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	2,020.3	25.9	1,994.4
Upper-stem portion	356.5	4.6	351.9
Total sawtimber	2,376.8	30.5	2,346.3
Poletimber trees	1,126.2	30.3	1,095.9
Total growing stock	3,503.0	60.8	3,442.2
Rough trees	310.1	3.2	306.9
Rotten trees	70.0	.1	69.9
Salvable dead trees	22.1	.4	21.7
All classes	3,905.2	64.5	3,840.7

Table 25. — *Net volume of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Indiana, 1967*

Ownership class	Growing stock: All species	Growing stock: Softwoods	Growing stock: Hardwoods	Sawtimber: All species	Sawtimber: Softwoods	Sawtimber: Hardwoods
	Million cubic feet			Million board feet 1/		
National Forest	155.8	9.4	146.4	353.5	9.2	344.3
Other public	248.7	14.1	234.6	836.0	48.7	787.3
Forest industry	20.6	.4	20.2	64.5	.8	63.7
Farmer and miscellaneous private	3,077.9	36.9	3,041.0	9,631.4	109.2	9,522.2
All ownerships	3,503.0	60.8	3,442.2	10,885.4	167.9	10,717.5

1/ International 1/4-inch rule.

Table 26. — *Net volume of growing stock on commercial forest land, by species and diameter classes, Indiana, 1967*
(Million cubic feet)

Species	All classes	Diameter class (inches at breast height): 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0 and larger
Softwoods:											
Shortleaf and loblolly pine	10.8	3.6	5.3	1.7	0.2	-	-	-	-	-	-
Other yellow pines	21.0	4.3	6.8	4.8	2.9	1.4	0.3	0.5	-	-	-
Cypress	11.6	-	-	-	-	-	-	.5	-	4.5	6.6
Other softwoods	17.4	4.7	5.6	3.4	2.0	1.1	-	.6	-	-	-
Total softwoods	60.8	12.6	17.7	9.9	5.1	2.5	.3	1.6	-	4.5	6.6
Hardwoods:											
White oak	495.9	26.1	49.8	63.7	67.5	74.0	68.0	43.9	35.1	57.6	10.2
Other select white oaks	50.6	1.5	3.0	3.6	3.0	4.5	4.0	4.4	6.7	14.2	5.7
Select red oaks	271.2	10.1	15.7	27.6	31.0	41.0	36.0	25.0	26.2	48.0	10.6
Other white oaks	119.9	4.7	10.0	18.0	22.4	26.2	17.6	11.6	3.7	4.8	.9
Black oak	318.5	12.1	20.9	32.5	43.2	48.2	41.6	41.0	28.3	44.2	6.5
Other red oaks	101.9	3.2	7.8	9.3	13.1	9.7	11.9	10.0	11.1	22.3	3.5
Hickory	441.8	43.0	62.2	82.0	72.8	64.4	50.8	24.4	17.0	22.0	3.2
Hard maple	287.6	30.3	41.2	41.8	42.1	37.9	40.3	21.9	13.5	17.3	1.3
Soft maple	126.3	12.4	17.2	16.1	15.0	17.4	13.0	9.1	6.4	14.8	4.9
Beech	132.0	3.4	9.0	9.6	12.1	17.4	17.4	17.7	14.3	26.4	4.7
Sweetgum	49.9	3.5	8.5	6.9	6.5	8.6	6.8	3.4	1.8	3.0	.9
Tupelo and blackgum	30.2	1.8	3.1	5.0	4.4	4.1	2.6	3.0	3.2	3.0	-
Ash	191.3	25.1	30.1	29.3	30.2	26.9	22.6	13.8	4.6	8.4	.3
Cottonwood	69.4	1.4	3.8	4.4	8.4	8.0	6.9	5.7	6.4	20.2	4.2
Aspen	25.0	3.4	4.1	6.9	4.7	3.6	1.6	.2	.5	-	-
Basswood	31.5	1.8	2.8	3.4	2.8	5.3	3.6	4.4	2.9	4.2	.3
Yellow-poplar	183.5	8.9	15.2	21.4	28.5	32.8	19.1	18.9	15.2	22.4	1.1
Black walnut	64.5	5.8	10.2	9.4	11.1	11.8	8.3	4.2	3.1	0.6	-
Black cherry	48.5	5.7	9.4	9.1	5.6	6.4	7.1	1.9	.7	2.6	-
Elm	95.9	12.4	18.7	17.7	15.8	6.9	7.9	6.1	3.2	7.2	-
Sycamore	149.8	4.9	12.1	17.4	13.8	15.7	16.7	13.8	15.7	26.7	13.0
Other hardwoods	157.0	26.6	28.2	29.7	24.3	17.0	10.6	6.4	6.6	6.1	1.5
Total hardwoods	3,442.2	248.1	383.0	464.8	478.3	487.8	414.4	290.8	226.2	376.0	72.8
All species	3,503.0	260.7	400.7	474.7	483.4	490.3	414.7	292.4	226.2	380.5	79.4

Table 27. —*Net volume of sawtimber on commercial forest land, by species and diameter classes, Indiana, 1967*

(Million board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0–10.9 [2]	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29.0 and larger
Softwoods:									
Shortleaf and loblolly pine	10.1	8.9	1.2	-	-	-	-	-	-
Other yellow pines	48.8	21.9	14.4	8.4	1.7	2.4	-	-	-
Cypress	78.7	-	-	-	-	2.4	-	31.4	44.9
Other softwoods	30.3	13.0	8.3	6.1	-	2.9	-	-	-
Total softwoods	167.9	43.8	23.9	14.5	1.7	7.7	-	31.4	44.9
Hardwoods:									
White oak	1,590.6	-	290.6	345.4	307.6	201.9	154.1	252.4	38.6
Other select white oaks	189.1	-	12.2	19.6	18.1	21.0	31.8	66.3	20.1
Select red oak	1,050.0	-	138.4	202.4	180.7	125.1	124.1	233.0	46.3
Other white oaks	427.9	-	107.8	128.4	88.2	58.1	18.8	21.7	4.9
Black oak	1,225.6	-	191.7	247.2	204.8	206.7	137.4	208.1	29.7
Other red oaks	354.0	-	55.2	42.4	50.1	46.7	50.3	97.1	12.2
Hickory	1,201.6	-	337.7	304.2	246.2	119.5	82.8	94.9	16.3
Hard maple	751.5	-	172.4	168.9	172.1	99.4	54.0	80.0	4.7
Soft maple	330.5	-	53.0	74.7	55.6	36.2	26.8	60.0	24.2
Beech	490.9	-	51.4	78.2	81.5	80.6	60.6	119.6	19.0
Sweetgum	131.8	-	26.0	34.5	29.3	14.4	8.0	15.3	4.3
Tupelo and blackgum	97.7	-	19.4	17.5	12.1	15.4	17.8	15.5	-
Ash	485.9	-	125.4	121.0	106.0	67.8	22.0	42.4	1.3
Cottonwood	279.2	-	31.8	38.2	31.7	28.5	31.2	97.9	19.9
Aspen	48.9	-	20.9	16.3	7.2	1.5	3.0	-	-
Basswood	111.4	-	13.4	24.0	18.2	21.7	13.2	19.0	1.9
Yellow-poplar	650.8	-	125.1	156.3	94.2	91.9	72.7	105.6	5.0
Black walnut	177.8	-	48.3	51.7	38.8	22.9	13.7	2.4	-
Black cherry	105.4	-	22.8	28.5	32.1	8.5	3.4	10.1	-
Elm	202.2	-	66.4	28.4	34.4	27.6	16.0	29.4	-
Sycamore	504.9	-	53.0	62.6	70.2	66.2	75.3	114.7	62.9
Other hardwoods	309.8	-	100.2	68.8	46.6	30.1	27.5	29.6	7.0
Total hardwoods	10,717.5	-	2,063.1	2,259.2	1,925.7	1,391.7	1,044.5	1,715.0	318.3
All species	10,885.4	43.8	2,087.0	2,273.7	1,927.4	1,399.4	1,044.5	1,746.4	363.2

[1] International 1/4-inch rule.

[2] Softwoods only.

Table 28. —*Net volume of sawtimber on commercial forest land, by species and quality classes, Indiana, 1967*
(Million board feet)[1]

Species	All classes	Log Grade 1	Log Grade 2	Log Grade 3	Log Grade 4
Softwoods:					
Shortleaf and loblolly pine	10.1	-	-	5.9	4.2
Other yellow pines	48.8	-	1.5	36.7	10.6
Cypress	78.7	27.3	22.6	28.8	-
Other softwoods	30.3	-	-	25.6	4.7
Total softwoods	167.9	27.3	24.1	97.0	19.5
Hardwoods:					
White oak	1,590.6	436.0	406.5	579.3	168.8
Other select white oaks	189.1	65.9	36.5	64.0	22.7
Select red oak	1,050.0	356.9	253.3	377.1	62.7
Other white oaks	427.9	79.9	156.0	167.9	24.1
Black oak	1,225.6	322.3	343.8	396.5	163.0
Other red oaks	354.0	33.9	54.3	136.9	128.9
Hickory	1,201.6	195.1	309.7	540.3	156.5
Hard maple	751.5	83.0	267.0	271.0	130.5
Soft maple	330.5	81.7	76.0	134.3	38.5
Beech	490.9	56.2	97.5	206.9	130.3
Sweetgum	131.8	30.4	39.3	52.8	9.3
Tupelo and blackgum	97.7	21.9	28.5	41.2	6.1
Ash	485.9	113.3	160.8	171.5	40.3
Cottonwood	279.2	112.1	57.1	97.6	12.4
Aspen	48.9	2.8	12.8	29.4	3.9
Basswood	111.4	42.8	32.0	34.7	1.9
Yellow-poplar	650.8	140.7	193.2	242.7	74.2
Black walnut	177.8	42.3	64.0	68.5	3.0
Black cherry	105.4	16.1	38.6	43.4	7.3
Elm	202.2	37.2	55.4	95.5	14.1
Sycamore	504.9	225.8	80.9	177.2	21.0
Other hardwoods	309.8	46.2	82.0	155.0	26.6
Total hardwoods	10,717.5	2,542.5	2,845.2	4,083.7	1,246.1
All species	10,885.4	2,569.8	2,869.3	4,180.7	1,265.6

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[1] International 1/4 inch rule.

Table 29. —*Percentage of sawtimber trees on commercial forest land by butt-log grades and species, Indiana, 1967*
(In percent)

Species	Percent of trees by butt-log grade			
	Grade 1	Grade 2	Grade 3	Grade 4
Softwoods:				
Shortleaf and loblolly pine	-	-	35	65
Other yellow pines	-	3	93	4
Cypress	46	36	18	-
Other softwoods	-	-	91	9
Total softwoods	2	3	77	18
Hardwoods:				
White ash	21	38	39	2
Other select white oaks	35	25	40	-
Select red oaks	25	33	38	4
Other white oaks	12	47	41	-
Black oak	19	34	43	4
Other red oaks	8	12	43	37
Hickory	12	35	48	5
Hard maple	14	31	51	4
Soft maple	11	32	53	4
Beech	9	24	55	12
Sweetgum	23	36	39	2
Tupelo and blackgum	23	38	39	-
Ash	18	40	41	1
Cottonwood	38	28	31	3
Aspen	4	20	76	-
Basswood	39	33	28	-
Yellow-poplar	19	38	38	5
Black walnut	12	38	50	-
Black cherry	14	49	37	-
Elm	14	30	54	2
Sycamore	30	28	41	1
Other hardwoods	12	31	56	1
Total hardwoods	18	34	44	4
All species	17	32	46	5

Table 30.—*Net volume of growing stock on commercial forest land, by species and Forest Survey Units, Indiana, 1967*
(Million cubic feet)

Species	All units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	10.8	0.3	10.4	-	0.1
Other yellow pines	21.0	.2	20.2	-	.6
Cypress	11.6	11.6	-	-	-
Other softwoods	17.4	1.4	11.5	0.4	4.1
Total softwoods	60.8	13.5	42.1	.4	4.8
Hardwoods:					
White oak	495.9	84.3	300.8	42.4	68.4
Other select white oaks	50.6	12.2	13.0	2.5	22.9
Select red oak	271.2	59.2	125.5	23.5	63.0
Other white oaks	119.9	2.9	107.9	1.0	8.1
Black oak	318.5	48.8	202.7	15.6	51.4
Other red oaks	101.9	28.9	37.6	4.9	30.5
Hickory	441.8	114.2	230.7	27.6	69.3
Hard maple	287.6	40.3	142.4	36.1	68.8
Soft maple	126.3	54.9	20.3	12.1	39.0
Beech	132.0	7.8	77.3	18.5	28.4
Sweetgum	49.9	16.9	20.4	7.3	5.3
Tupelo and blackgum	30.2	8.6	18.8	1.9	.9
Ash	191.3	45.1	64.1	13.7	68.4
Cottonwood	69.4	10.6	10.5	1.0	47.3
Aspen	25.0	3.1	7.6	2.5	11.8
Basswood	31.5	4.3	10.8	1.6	14.8
Yellow-poplar	183.5	55.3	92.5	12.6	23.1
Black walnut	64.5	17.5	21.2	2.5	23.3
Black cherry	48.5	5.8	19.9	3.9	18.9
Elm	95.9	27.1	37.9	3.7	27.2
Sycamore	149.8	41.9	71.2	2.8	33.9
Other hardwoods	157.0	63.0	49.6	4.6	39.8
Total hardwoods	3,442.2	752.7	1,682.7	242.3	764.5
All species	3,503.0	766.2	1,724.8	242.7	769.3

Table 31.—*Net volume of sawtimber on commercial forest land, by species and Forest Survey Units, Indiana, 1967*
(Million board feet)[1]

Species	All units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	10.1	-	10.1	-	-
Other yellow pines	48.8	-	48.8	-	-
Cypress	78.7	78.7	-	-	-
Other softwoods	30.3	1.3	22.0	0.1	6.9
Total softwoods	167.9	80.0	80.9	.1	6.9
Hardwoods:					
White oak	1,590.6	275.8	926.7	149.6	238.5
Other select white oaks	189.1	47.2	41.4	6.3	94.2
Select red oak	1,050.0	225.0	488.3	93.4	243.3
Other white oaks	427.9	9.7	382.6	3.9	31.7
Black oak	1,225.6	181.2	794.2	42.6	207.6
Other red oaks	354.0	106.0	142.6	18.9	86.5
Hickory	1,201.6	322.6	623.4	80.7	174.9
Hard maple	751.5	89.9	333.3	87.4	240.9
Soft maple	330.5	134.2	48.1	37.8	110.4
Beech	490.9	22.5	291.7	63.2	113.5
Sweetgum	131.8	47.9	53.3	21.4	9.2
Tupelo and blackgum	97.7	24.5	64.2	6.6	2.4
Ash	485.9	102.0	168.1	31.9	183.9
Cottonwood	279.2	39.9	42.2	3.5	193.6
Aspen	48.9	11.8	13.3	7.3	16.5
Basswood	111.4	17.2	43.9	5.6	44.7
Yellow-poplar	650.8	187.6	328.9	52.3	82.0
Black walnut	177.8	42.0	60.0	2.2	73.6
Black cherry	105.4	12.8	50.4	6.0	36.2
Elm	202.2	48.6	86.4	4.9	62.3
Sycamore	504.9	135.0	231.1	6.0	132.8
Other hardwoods	309.8	108.1	88.1	8.5	105.1
Total hardwoods	10,717.5	2,191.5	5,302.2	740.0	2,483.8
All species	10,885.4	2,271.5	5,383.1	740.1	2,490.7

[1] International 1/4-inch rule.

Table 32.—*Net volume of growing stock and sawtimber on commercial forest land, by species, Indiana, 1967*

Species	Growing stock	Sawtimber
	Million cubic feet	Million board feet[1]
Softwood species:		
Shortleaf and loblolly pine		
Shortleaf pine	10.8	10.1
Other yellow pines		
Virginia pine	21.0	48.8
Cypress	11.6	78.7
Other eastern softwood group		
Eastern redcedar	11.2	22.1
Tamarack	2.0	6.5
Scotch pine	.4	-
Red pine	1.3	-
White pine	2.5	1.7
Total softwoods	60.8	167.9
Hardwood species:		
Select white oak		
White oak	495.9	1,590.6
Other select white oak group		
Swamp white oak	8.6	34.3
Bur oak	6.6	27.7
Swamp chestnut oak	.8	3.7
Chinkapin oak	34.6	123.4
Select red oak		
Northern red oak	270.5	1,047.5
Cherry bark oak	.1	.4
Shumard oak	.6	2.1
Other white oak group		
Chestnut oak	115.9	414.8
Post oak	4.0	13.1
Other red oaks		
Black oak	318.5	1,225.6
Other red oak group		
Scarlet oak	13.1	58.3
Southern red oak	.3	1.7
Shingle oak	4.2	8.6
Pin oak	84.3	285.4
Hickory group		
Mockernut hickory	36.6	104.5
Shagbark hickory	155.3	390.4
Shellbark hickory	16.1	61.6
Pecan	8.6	40.4
Pignut hickory	145.2	370.0
Bitternut hickory	80.0	234.7
Hard maple		
Sugar maple	287.6	751.5
Soft maple group		
Red maple	108.6	289.1
Silver maple	12.2	37.0
Boxelder	5.5	4.4
Hardwood species (Continued):		
Beech	132.0	490.9
Sweetgum	49.9	131.8
Tupelo and blackgum		
Swamp tupelo	30.2	97.7
Ash group		
White ash	185.6	479.5
Black ash	4.5	5.6
Green ash	.3	-
Blue ash	.9	.8
Cottonwood		
Eastern cottonwood	69.4	279.2
Aspen group		
Balsam poplar	.5	3.0
Bigtooth aspen	22.2	42.2
Quaking aspen	2.3	3.7
Basswood	31.5	111.4
Yellow-poplar	183.5	650.8
Black walnut	64.5	177.8
Black cherry	48.5	105.4
Elm group		
Winged elm	.7	-
American elm	45.0	86.5
Siberian elm	.7	-
Slippery elm	48.3	115.7
Rock elm	1.2	-
Sycamore	149.8	504.9
Other eastern hardwood group		
Yellow birch	2.7	7.7
River birch	8.4	22.6
Paper birch	-	-
Ohio buckeye	3.4	9.7
Hackberry	23.8	69.1
Northern catalpa	.7	3.2
Flowering dogwood	.4	-
Common persimmon	8.4	5.6
Honeylocust	11.7	33.6
Kentucky coffeetree	2.9	9.8
Butternut	6.5	14.3
Osage-orange	.7	-
Cucumber	-	.3
Black locust	21.5	17.4
Black willow	18.8	50.6
Sassafras	47.1	65.9
Total hardwoods	3,442.2	10,717.5
All species	3,503.0	10,885.4

[1] International 1/4-inch rule.

Table 33. — *Cubic-foot volume in short-log trees on commercial forest land, by species and diameter classes, Indiana, 1967*

(Million cubic feet)

Species	All diameters	Diameter class (inches at breast height)							
		11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0 and larger
Softwoods:									
Shortleaf and loblolly pine	0.1	0.1	-	-	-	-	-	-	-
Total softwoods	.1	.1	-	-	-	-	-	-	-
Hardwoods:									
White oak	15.4	1.8	2.2	1.7	2.0	1.6	1.7	3.0	1.4
Other select white oaks	1.2	.2	-	-	.3	.2	-	.3	.2
Select red oak	5.3	.4	.8	.8	.8	-	.3	2.2	-
Other white oaks	1.5	.2	.9	-	.2	.2	-	-	-
Black oak	12.0	1.8	1.5	1.8	1.8	1.9	.9	.9	1.4
Other red oaks	2.5	.6	.3	.5	.7	.3	-	.1	-
Hickory	7.1	2.0	1.9	1.1	1.0	.9	.2	-	-
Hard maple	9.0	2.1	1.8	1.1	2.2	.2	.7	.9	-
Soft maple	5.8	2.3	1.4	.6	.2	.3	.2	.6	.2
Beech	4.5	1.2	.3	1.0	1.0	.6	.2	.2	-
Sweetgum	.6	.2	-	-	-	.1	.3	-	-
Tupelo and blackgum	.1	-	.1	-	-	-	-	-	-
Ash	4.4	1.7	.7	.7	.5	.1	.2	.5	-
Cottonwood	.2	-	-	-	-	-	-	.2	-
Basswood	1.0	-	-	.8	-	-	-	.2	-
Yellow-poplar	.7	.3	-	-	-	-	-	.4	-
Black walnut	6.1	1.5	.4	.6	3.5	.1	-	-	-
Black cherry	1.2	.5	.7	-	-	-	-	-	-
Elm	1.8	.9	.1	.2	.5	-	-	-	.1
Sycamore	2.0	.1	.5	.6	.2	-	.6	-	-
Other hardwoods	3.3	1.1	.8	.8	-	-	.4	.2	-
Total hardwoods	85.7	18.9	14.4	12.3	14.9	6.5	5.7	9.7	3.3
All species	85.8	19.0	14.4	12.3	14.9	6.5	5.7	9.7	3.3

Table 34. — *Sawtimber volume in short-log trees on commercial forest land, by species and diameter classes, Indiana, 1967*
(Million board feet)[1]

Species	All diameters	Diameter class (inches at breast height) 9.0-[2] 10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0 and larger
Softwoods:										
Shortleaf and loblolly pine	0.3	0.1	0.2	-	-	-	-	-	-	-
Other yellow pines	.1	-	-	-	-	-	0.1	-	-	-
Other softwoods	.1	.1	-	-	-	-	-	-	-	-
Total softwoods	.5	.2	.2	-	-	-	.1	-	-	-
Hardwoods:										
White oak	43.1	-	3.9	5.7	3.7	6.3	4.3	4.1	8.8	6.3
Other select white oaks	4.2	-	.4	-	-	1.2	.6	-	.7	1.3
Select red oak	14.4	-	1.2	1.9	2.6	2.1	-	.9	5.7	-
Other white oaks	3.6	-	.4	2.1	.1	.6	.4	-	-	-
Black oak	31.6	-	4.8	3.8	4.8	4.8	4.8	2.7	2.4	3.5
Other red oaks	6.9	-	1.9	.8	1.4	1.5	.7	-	.6	-
Hickory	19.3	-	5.4	5.2	2.6	2.6	3.0	.5	-	-
Hard maple	22.2	-	3.7	4.4	3.0	5.3	.5	1.9	3.4	-
Soft maple	11.7	-	3.9	2.7	1.3	.6	.7	.7	1.2	.6
Beech	13.3	-	3.1	.6	2.3	3.6	1.3	.8	1.6	-
Sweetgum	1.1	-	.3	-	-	-	.4	.4	-	-
Tupelo and blackgum	.1	-	-	.1	-	-	-	-	-	-
Ash	11.8	-	3.9	2.4	1.9	1.3	.2	.8	1.3	-
Cottonwood	.8	-	-	-	-	-	-	-	.8	-
Basswood	2.8	-	-	-	2.0	-	-	-	.8	-
Yellow-poplar	2.0	-	.5	-	.1	-	-	-	1.4	-
Black walnut	6.9	-	3.4	.8	1.3	1.2	.2	-	-	-
Black cherry	2.7	-	1.3	1.4	-	-	-	-	-	-
Elm	4.9	-	2.3	.2	.6	1.4	-	-	-	.4
Sycamore	3.5	-	-	1.0	1.0	.4	-	1.1	-	-
Other hardwoods	8.9	-	2.8	1.8	2.2	-	-	.9	1.2	-
Total hardwoods	215.8	-	43.2	34.9	30.9	32.9	17.1	14.8	29.9	12.1
All species	216.3	.2	43.4	34.9	30.9	32.9	17.2	14.8	29.9	12.1

[1] International 1/4-inch rule.

[2] Softwoods only.

Table 35. — *Net volume of growing stock on commercial forest land, by species and forest types, Indiana, 1967*

(Million cubic feet)

Species	All forest types	Loblolly-shortleaf pine	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch
Softwoods:								
Shortleaf and loblolly pine	10.8	6.8	3.6	0.1	-	-	0.2	0.1
Other yellow pines	21.0	13.2	4.6	2.5	-	0.1	-	.6
Cypress	11.6	-	-	-	11.6	-	-	-
Other softwoods	17.4	2.3	4.4	6.8	-	.5	3.3	.1
Total softwoods	60.8	22.3	12.6	9.4	11.6	.6	3.5	.8
Hardwoods:								
White oak	495.9	.1	4.0	442.6	.7	5.2	43.3	-
Other select white oaks	50.6	-	-	33.7	4.1	5.0	7.8	-
Select red oak	271.2	-	1.6	225.8	3.0	5.2	35.0	.6
Other white oaks	119.9	.3	.1	114.6	-	-	4.9	-
Black oak	318.5	1.7	2.0	295.8	1.2	3.3	14.5	-
Other red oaks	101.9	-	-	78.1	9.1	8.8	5.5	.4
Hickory	441.8	.1	2.3	358.7	2.5	22.9	55.3	-
Hard maple	287.6	.3	1.2	89.9	-	4.8	191.4	-
Soft maple	126.3	-	-	30.7	6.5	68.7	19.4	1.0
Beech	132.0	.1	-	38.2	-	1.8	91.9	-
Sweetgum	49.9	.3	.2	30.4	10.2	1.7	6.4	.7
Tupelo and blackgum	30.2	-	-	21.4	.4	.7	7.7	-
Ash	191.3	.3	1.2	88.6	5.4	43.9	51.9	-
Cottonwood	69.4	-	-	3.8	.8	61.1	3.7	-
Aspen	25.0	-	-	18.6	.3	3.0	1.1	2.0
Basswood	31.5	-	-	8.4	-	4.3	18.8	-
Yellow-poplar	183.5	.1	.9	139.3	.1	7.7	35.2	.2
Black walnut	64.5	-	-	28.2	.4	15.5	20.4	-
Black cherry	48.5	.1	.4	24.8	-	4.3	18.9	-
Elm	95.9	-	.2	36.8	.4	18.9	39.5	.1
Sycamore	149.8	.8	.2	45.1	2.5	83.9	17.3	-
Other hardwoods	157.0	.1	1.0	67.8	2.8	40.2	41.2	3.9
Total hardwoods	3,442.2	4.3	15.3	2,221.3	50.4	410.9	731.1	8.9
All species	3,503.0	26.6	27.9	2,230.7	62.0	411.5	734.6	9.7

Table 36. — *Net volume of sawtimber on commercial forest land, by species and forest types, Indiana, 1967*
(Million board feet)[1]

Species	All forest types	Loblolly-shortleaf pine	Oak pine	Oak-hickory	Oak-gum-cypress	Elm-ash-Cottonwood	Maple-beech-birch	Aspen-birch
Softwoods:								
Shortleaf and loblolly pine	10.1	7.8	2.3	-	-	-	-	-
Other yellow pines	48.8	29.7	12.3	6.8	-	-	-	-
Cypress	78.7	-	-	-	78.7	-	-	-
Other softwoods	30.3	.4	14.8	7.2	-	-	7.9	-
Total softwoods	167.9	37.9	29.4	14.0	78.7	-	7.9	-
Hardwoods:								
White oak	1,590.6	.4	10.5	1,381.6	3.1	16.2	178.8	-
Other select white oaks	189.1	-	-	126.5	15.2	22.3	25.1	-
Select red oak	1,050.0	-	4.7	859.5	11.6	19.5	154.1	0.6
Other white oaks	427.9	.6	.5	410.5	-	-	16.3	-
Black oak	1,225.6	7.0	8.5	1,142.6	3.3	10.8	53.4	-
Other red oaks	354.0	-	-	265.5	36.8	29.1	21.0	1.6
Hickory	1,201.6	.4	5.8	920.1	11.1	83.1	181.1	-
Hard maple	751.5	-	2.8	184.9	-	9.4	554.4	-
Soft maple	330.5	-	-	77.9	21.4	167.8	63.4	-
Beech	490.9	.2	-	130.4	-	7.3	353.0	-
Sweetgum	131.8	-	-	81.4	27.1	3.8	18.9	.6
Tupelo and blackgum	97.7	-	-	64.9	2.1	1.7	29.0	-
Ash	485.9	.2	.9	214.3	8.6	90.5	171.4	-
Cottonwood	279.2	-	-	14.9	3.4	251.3	9.6	-
Aspen	48.9	-	-	37.3	-	5.5	3.9	2.2
Basswood	111.4	-	-	22.3	-	15.2	73.9	-
Yellow-poplar	650.8	.4	1.8	494.3	-	24.4	129.9	-
Black walnut	177.8	-	-	59.2	1.5	44.7	72.4	-
Black cherry	105.4	-	1.9	48.6	-	4.8	50.1	-
Elm	202.2	-	-	72.8	.7	44.0	84.7	-
Sycamore	504.9	1.0	-	141.3	10.5	301.9	50.2	-
Other hardwoods	309.8	-	1.1	89.3	9.8	118.1	88.1	3.4
Total hardwoods	10,717.5	10.2	38.5	6,840.1	166.2	1,271.4	2,382.7	8.4
All species	10,885.4	48.1	67.9	6,854.1	244.9	1,271.4	2,390.6	8.4

[1] International 1/4-inch rule.

ble 37. — *Walnut volume on nonforest land, by diameter classes, Indiana, 1967*

ameter class nches at east height)	Growing stock	Sawtimber	Short-log trees	
	Thousand cubic feet	Thousand board feet[1]	Thousand cubic feet	Thousand board feet[1]
5.0- 6.9	122	-	-	-
7.0- 8.9	478	-	-	-
9.0-10.9	827	-	-	-
1.0-12.9	674	3,011	435	1,011
3.0-14.9	1,756	6,660	832	2,391
5.0-16.9	2,515	8,479	172	457
7.0-18.9	560	2,486	-	-
9.0-20.9	431	2,304	635	2,711
1.0-22.9	599	2,027	-	-
3.0-24.9	285	776	181	654
5.0+	-	-	390	792
11 diameters	8,247	25,743	2,645	8,016

[1] International 1/4-inch rule.

Table 38. — *Walnut volume on nonforest land, by Forest Survey Units, Indiana, 1967*

Survey Unit	Growing stock	Sawtimber	Short-log trees	
	Thousand cubic feet	Thousand board feet[1]	Thousand cubic feet	Thousand board feet[1]
Lower Wabash Unit	1,078	4,177	426	1,329
Knobs Unit	2,113	7,350	469	1,403
Upland Flats Unit	1,480	4,749	169	484
Northern Unit	3,576	9,467	1,581	4,800
All Units	8,247	25,743	2,645	8,016

[1] International 1/4-inch rule

Table 39. — *Net volume of growing stock on commercial forest land, by counties and species groups, Indiana, 1967*

(Million cubic feet)

County	All species	Soft-woods	White oak group	Red oak group	Hickory	Hard maple	Soft maple	Beech	Ash	Cotton-wood	Yellow-poplar	Sycamore	Other hard-woods
Adams	13.6	-	1.6	2.4	1.1	0.8	0.8	0.2	1.1	1.5	0.4	1.3	2.4
Allen	30.2	0.2	3.6	4.8	2.5	2.0	1.7	.9	2.6	3.2	.8	2.3	5.6
Bartholomew	33.4	-	4.2	5.6	2.8	4.0	1.7	1.9	3.3	1.5	.8	1.6	6.0
Benton	.8	-	.1	.2	-	-	.1	-	.1	-	-	.1	.2
Blackford	6.3	.1	.8	1.1	.5	.7	.3	.2	.5	.7	.1	.2	1.1
Boone	6.1	.3	1.0	1.3	.7	.5	.3	.1	.6	-	.2	.2	.9
Brown	144.1	2.3	38.1	33.1	19.4	11.5	1.8	6.8	5.1	.2	7.9	3.9	14.0
Carroll	11.8	.1	1.9	2.2	1.4	.7	.5	.2	1.2	.2	.4	.5	2.5
Cass	17.1	.1	2.1	3.2	1.5	2.0	.7	.8	1.7	.8	.4	.4	3.4
Clark	93.9	4.9	23.8	19.9	12.1	7.4	1.1	3.7	3.6	.4	4.5	2.9	9.6
Clay	47.5	.6	5.9	9.0	7.2	2.5	2.9	.4	2.8	.5	3.6	2.8	9.3
Clinton	6.9	.1	.6	1.0	.5	.7	.5	.2	.9	.1	.2	.4	1.7
Crawford	103.7	2.9	26.7	22.9	14.3	7.5	1.0	4.5	3.6	.4	5.8	3.8	10.3
Daviess	39.0	-	5.0	6.9	6.3	1.8	3.2	.5	2.4	.7	2.5	2.1	7.6
Dearborn	23.0	-	4.4	3.7	2.2	3.5	1.5	2.2	1.2	-	1.3	.1	2.9
Decatur	21.8	.2	2.6	3.8	1.6	2.4	1.1	1.3	2.1	1.0	.5	1.2	4.0
De Kalb	18.7	.1	1.8	3.1	1.4	1.3	1.1	.5	1.7	2.4	.5	1.4	3.4
Delaware	10.4	-	1.1	1.8	.7	1.5	.5	.7	.8	.3	.3	.4	2.3
Dubois	100.8	2.1	23.3	20.9	13.4	8.5	1.5	4.5	4.1	.9	5.1	4.4	12.1
Elkhart	18.4	.1	2.3	3.5	1.5	1.3	1.3	.6	1.8	1.2	.4	.7	3.7
Fayette	12.7	-	2.3	2.2	1.1	1.9	.7	1.1	.7	.1	.8	.1	1.7
Floyd	38.8	1.5	9.8	8.6	5.2	3.1	.4	1.8	1.3	.1	2.1	.9	4.0
Fountain	25.7	.3	2.9	4.5	2.4	3.3	1.2	1.2	2.2	1.3	.6	1.3	4.5
Franklin	42.5	.1	8.3	7.7	4.7	7.1	2.0	3.1	2.4	.3	2.0	.4	4.4
Fulton	14.3	.1	2.0	2.9	1.3	1.3	.8	.6	1.0	1.0	.4	.3	2.6
Gibson	48.6	.9	6.0	7.1	6.4	2.8	5.0	.5	3.2	1.0	3.0	3.1	9.6
Grant	10.8	-	1.3	2.0	.9	1.5	.5	.8	.8	.6	.4	.2	1.8
Greene	88.1	.3	12.3	17.7	13.5	4.5	5.5	.9	5.0	.7	7.0	3.9	16.8
Hamilton	11.2	-	1.7	2.1	1.0	.8	.5	.3	1.0	1.6	.3	.3	1.6
Hancock	6.0	-	.5	.9	.5	.9	.2	.2	.8	.1	.2	.2	1.5
Harrison	122.0	4.8	29.3	26.0	16.6	9.3	1.3	5.4	4.4	.6	6.7	5.0	12.6
Hendricks	12.3	-	1.5	2.1	1.2	.7	.7	.4	1.3	.6	.5	1.1	2.2
Henry	12.1	-	1.6	2.2	1.1	1.5	.4	.6	1.0	.2	.5	.3	2.7
Howard	5.9	.1	.7	1.0	.5	.4	.3	.1	.5	.7	.1	.6	.9
Huntington	15.9	.3	2.3	3.0	1.4	1.3	1.0	.4	1.3	1.1	.5	.6	2.7
Jackson	118.7	2.3	28.3	24.9	14.9	10.4	1.7	5.6	4.6	.9	6.0	5.4	13.7
Jasper	18.3	.2	2.6	4.1	1.9	1.2	.7	.6	1.6	1.0	.6	.6	3.2
Jay	18.2	-	1.8	3.3	1.4	2.4	.9	.9	1.6	1.5	.4	.6	3.4
Jefferson	42.5	.1	8.2	8.1	5.5	5.8	2.0	2.6	2.7	-	2.1	.5	4.9
Jennings	56.6	-	10.8	10.1	7.1	9.2	2.7	4.6	2.7	.2	2.9	.5	5.8
Johnson	10.5	-	1.3	2.3	.9	.9	.8	.4	.8	.5	.3	.4	1.9
Knox	34.2	.9	4.0	5.5	4.4	1.7	4.5	.3	2.1	.9	2.3	1.9	5.7
Kosciusko	22.4	.1	2.9	4.0	1.9	2.4	.8	.8	2.1	1.1	.7	1.3	4.3
Lagrange	13.9	.2	2.2	2.8	1.4	.9	.6	.3	1.2	.5	.4	1.1	2.3
Lake	8.5	-	1.5	1.7	.7	.3	.4	.2	.7	1.4	.1	.3	1.2
La Porte	21.5	.1	3.3	4.9	2.1	1.3	.9	.5	1.7	1.6	.8	.6	3.7
Lawrence	111.0	1.3	25.3	22.6	15.2	9.0	1.3	5.7	4.1	1.1	6.7	6.2	12.5
Madison	8.2	.1	.5	1.0	.5	1.6	.4	.7	.8	.2	.2	.4	1.8
Marion	11.1	-	1.3	2.0	.9	1.3	.5	.7	1.2	.3	.3	.4	2.2
Marshall	21.2	.3	3.2	4.5	2.1	1.7	.8	.7	1.8	.5	.6	1.3	3.7

(Continued on next page)

Table 39 (Continued)

County	All species	Soft- woods	White oak group	Red oak group	Hickory	Hard maple	Soft maple	Beech	Ash	Cotton- wood	Yellow- poplar	Sycamore	Other hard- woods
Martin	113.0	1.0	16.5	23.5	18.0	6.6	5.3	1.3	5.9	.6	9.4	5.3	19.6
Miami	15.3	-	2.2	2.9	1.6	1.6	.8	.6	1.3	.5	.5	.7	2.6
Monroe	132.5	3.1	33.6	29.5	17.6	10.6	1.3	5.3	4.9	.6	7.5	1.8	13.7
Montgomery	18.0	.3	2.7	4.0	2.0	1.0	.8	.5	1.4	.7	.9	.6	3.1
Morgan	88.3	1.5	22.5	18.8	11.5	7.4	1.1	3.1	3.5	.4	4.7	3.8	10.0
Newton	12.0	-	1.6	2.6	1.2	.6	.8	.2	1.3	.3	.3	[illegible]	2.6
Noble	18.7	.1	2.7	4.2	1.9	1.4	.8	.6	1.4	1.3	.5	.4	3.4
Ohio	8.3	-	1.5	1.4	1.0	1.7	.3	.6	.4	-	.5	.1	.8
Orange	105.5	3.4	23.5	20.2	13.6	9.4	1.0	5.0	3.7	1.4	5.9	6.9	11.5
Owen	113.0	1.7	29.9	25.2	15.2	8.8	1.3	4.6	4.1	.4	5.9	4.1	11.8
Parke	81.4	.9	10.9	15.4	12.2	4.1	5.5	[illegible].7	4.8	.9	6.6	4.0	15.4
Perry	146.3	6.3	37.0	31.9	19.4	11.4	1.5	6.3	5.3	.6	7.7	4.8	14.1
Pike	52.3	1.0	6.0	8.2	7.3	2.3	4.1	.4	3.4	.9	3.2	3.4	12.1
Porter	20.9	.1	2.8	4.0	2.1	1.5	1.2	.7	2.2	.6	.8	.8	4.1
Posey	43.0	1.7	5.3	6.7	5.9	2.2	2.9	.5	2.5	1.0	2.8	3.5	8.0
Pulaski	19.1	-	2.8	3.6	2.0	1.9	.8	.6	1.6	.8	.7	.6	3.7
Putnam	69.7	1.8	9.9	13.1	11.2	3.9	4.0	.8	3.9	.6	5.5	3.2	11.8
Randolph	12.6	-	1.6	2.6	.9	1.3	.7	.5	1.2	.8	.4	.3	2.3
Ripley	32.4	.1	5.9	5.8	3.6	4.4	1.7	2.4	2.1	.2	1.8	.6	3.8
Rush	10.5	-	1.1	1.4	.8	1.3	.6	.5	1.1	.8	.3	.5	2.1
St. Joseph	18.3	.1	2.7	3.8	1.6	1.2	1.1	.6	1.6	1.1	.5	.6	3.4
Scott	47.7	.4	11.7	10.0	6.0	4.2	.6	2.0	1.8	.7	2.6	2.9	4.8
Shelby	8.6	.1	.4	1.1	.7	1.1	.4	.4	1.0	.7	.2	.4	2.1
Spencer	62.3	.8	11.9	11.0	8.7	6.4	.8	3.6	2.6	.8	3.3	4.0	8.4
Starke	21.8	.1	2.8	4.6	1.9	1.6	.8	.5	1.6	2.8	.8	.6	3.7
Steuben	17.0	.4	2.0	3.6	1.6	1.4	.7	.7	1.2	1.7	.5	.4	2.8
Sullivan	49.8	.9	5.8	7.6	7.5	2.5	4.3	.6	3.3	1.0	3.0	2.5	10.8
Switzerland	15.9	.1	3.0	3.4	1.6	1.4	.7	1.1	1.0	-	.9	.3	2.4
Tippecanoe	13.4	.1	1.8	2.5	1.3	1.4	.7	.6	1.1	.2	.5	.4	2.8
Tipton	5.1	-	.5	1.0	.4	.5	.4	.2	.5	.7	.1	.2	.6
Union	8.8	-	1.5	1.6	.8	1.1	.5	.8	.5	.2	.3	.2	1.3
Vanderburgh	19.5	.4	2.4	3.3	2.8	1.2	1.5	.2	1.2	.4	1.4	1.2	3.5
Vermillion	37.2	2.1	4.4	5.9	5.1	2.0	3.1	.3	1.8	.4	2.3	2.4	7.4
Vigo	42.9	1.0	5.0	7.0	6.4	2.2	3.1	.4	2.8	1.0	2.7	2.6	8.7
Wabash	17.2	.2	2.1	3.1	1.6	1.1	1.3	.5	1.5	1.4	.6	.7	3.1
Warren	19.1	-	2.5	3.4	1.9	1.5	1.0	.7	1.5	1.3	.7	1.2	3.4
Warrick	53.7	.7	11.1	9.7	7.8	4.6	.9	2.1	2.2	.5	2.9	3.3	7.9
Washington	142.5	2.1	35.9	30.6	19.8	12.9	1.7	7.3	5.2	.5	7.2	4.1	15.2
Wayne	16.8	.1	2.0	3.1	1.4	1.4	.8	.6	1.6	.6	.6	.8	3.8
Wells	16.1	-	2.1	2.8	1.5	1.3	1.1	.6	1.4	1.2	.4	1.0	2.7
White	9.6	-	2.0	2.4	1.1	.7	.4	.2	.7	.1	.4	.3	1.3
Whitley	15.7	.1	2.2	2.9	1.5	1.4	.8	.6	1.4	1.0	.5	.3	3.0
All counties	3,503.0	60.8	666.4	691.6	441.8	287.6	126.3	132.0	191.3	69.4	183.5	149.8	502.5

Table 40. — *Net volume of sawtimber on commercial forest land, by counties and species groups, Indiana, 1967*

(Million board feet)[1]

Species	All species	Softwoods	White oak group	Red oak group	Hickory	Hard maple	Soft maple	Beech	Ash	Cottonwood	Yellow-poplar	Sycamore	Other hardwoods
Adams	45.0	-	5.9	9.0	3.0	2.7	1.8	.9	3.2	6.3	1.4	5.7	5
Allen	97.4	.5	12.5	17.7	6.3	6.9	4.7	3.7	6.9	13.1	3.0	9.5	12
Bartholomew	114.3	-	16.2	21.5	7.0	14.6	5.0	7.6	8.9	7.2	2.9	6.9	16
Benton	1.7	-	.2	.7	.1	.1	.3	-	.1	-	.1	.1	
Blackford	21.5	.2	2.9	4.5	1.5	2.2	.7	.9	1.5	2.9	.4	.5	3
Boone	18.7	-	3.7	4.9	1.6	1.8	.8	.5	1.5	.1	.6	.6	2
Brown	462.6	3.9	125.8	132.1	51.7	26.8	4.1	25.4	14.1	.6	27.6	13.9	36
Carroll	35.4	.3	7.1	8.3	3.2	2.1	1.5	1.0	2.3	.2	1.5	1.9	6
Cass	56.1	.3	7.9	12.4	3.7	7.1	2.2	3.2	4.6	2.7	1.5	1.3	9
Clark	285.3	11.8	73.6	76.8	32.1	16.8	2.6	14.0	8.5	1.1	15.9	8.6	23
Clay	141.0	3.0	19.5	33.8	21.2	5.7	7.2	1.1	6.0	1.9	12.3	9.7	19
Clinton	22.6	.2	2.1	3.8	1.2	2.7	1.5	.8	2.6	.5	.6	1.5	5
Crawford	307.1	5.6	81.4	85.8	35.2	16.7	2.4	15.6	8.6	1.8	19.8	10.7	23
Daviess	112.4	-	17.5	26.3	18.7	3.8	6.4	1.2	5.1	2.5	8.4	6.7	15
Dearborn	73.4	-	16.4	13.9	6.6	8.5	5.4	7.5	2.9	-	5.6	.2	6
Decatur	71.7	.3	9.7	14.1	4.1	8.7	3.3	5.1	5.6	4.3	1.8	4.8	9
De Kalb	60.8	.2	5.8	11.3	3.6	4.8	3.0	2.0	4.5	9.7	1.9	5.9	8
Delaware	34.0	-	4.3	6.4	1.8	5.7	1.1	3.0	2.5	.8	1.1	1.6	5
Du bois	330.2	4.2	76.7	85.4	40.1	20.9	4.0	18.0	11.5	3.7	18.7	14.8	32
Elkhart	60.6	.2	8.4	13.0	3.6	4.4	3.7	2.6	5.3	5.5	1.6	2.6	9
Fayette	40.1	-	8.5	8.3	3.4	4.6	2.5	3.8	1.3	.5	3.4	.3	3
Floyd	122.9	4.4	31.7	33.8	13.7	7.5	1.0	6.9	3.6	.4	7.3	3.2	9
Fountain	84.4	.5	10.3	15.6	5.8	13.0	3.6	5.1	6.3	5.6	2.1	5.2	11
Franklin	131.8	-	29.2	27.2	13.3	18.0	6.4	10.6	5.9	.9	8.5	1.1	10
Fulton	47.4	.3	7.6	11.2	3.5	3.9	2.3	2.3	2.8	4.5	1.6	1.2	6
Gibson	151.6	5.6	21.8	27.4	18.8	6.7	12.5	1.7	7.2	3.7	10.2	10.1	25
Grant	36.3	-	4.7	7.5	2.3	5.5	1.3	2.9	2.6	2.7	1.1	.8	4
Greene	245.3	.2	39.9	65.1	35.6	9.1	11.9	2.4	11.2	2.9	23.3	11.7	32
Hamilton	38.4	-	6.4	8.1	2.9	2.9	1.6	1.3	2.7	6.6	.9	1.2	3
Hancock	20.4	.2	1.8	3.4	1.4	3.5	.5	.6	2.4	.6	.6	1.0	4
Harrison	380.8	8.1	95.9	103.0	44.7	21.4	3.1	20.7	12.0	2.6	23.4	15.1	30
Hendricks	38.2	-	5.6	7.6	2.8	1.7	2.2	1.7	2.8	2.3	1.8	4.3	5
Henry	38.6	.2	6.0	8.4	3.1	4.9	1.1	2.3	2.7	.2	1.6	1.1	7
Howard	18.6	-	2.1	3.6	1.0	1.3	1.1	.4	1.5	2.7	.4	2.6	1
Huntington	50.1	.2	8.7	10.7	3.4	4.4	2.5	1.7	3.6	4.5	1.8	2.3	6
Jackson	372.1	4.2	91.2	96.0	40.6	24.6	3.9	21.7	12.4	3.6	22.3	17.1	34
Jasper	55.7	.2	9.5	14.8	4.3	3.5	2.3	2.3	3.6	4.1	2.2	1.9	7
Jay	63.0	-	6.6	12.4	3.8	9.3	2.5	3.6	5.2	6.6	1.4	2.6	9
Jefferson	126.2	.1	27.7	27.5	16.2	13.6	5.5	9.0	6.5	.1	8.5	.9	10
Jennings	175.5	-	37.2	36.2	21.8	22.5	8.5	15.5	6.8	.5	11.6	.9	14
Johnson	35.4	-	4.9	8.5	2.5	3.1	2.1	1.7	2.5	2.2	1.2	1.5	5
Knox	102.1	5.6	13.8	19.7	13.0	4.1	10.1	.9	3.9	3.4	7.6	6.1	13
Kosciusko	74.0	.2	10.7	14.8	4.6	8.6	2.5	3.2	5.8	4.4	2.5	5.3	11
Lagrange	45.2	.2	8.0	10.2	3.6	3.2	1.8	1.4	3.0	1.9	1.5	4.5	5
Lake	29.4	-	5.9	7.0	2.3	1.0	.9	.7	1.4	6.0	.5	1.1	2
La Porte	67.8	-	12.2	18.9	5.0	4.1	2.5	2.0	3.7	6.5	2.7	1.9	8
Lawrence	350.9	2.2	83.2	88.7	41.7	20.9	3.2	20.9	11.1	4.5	23.7	19.9	30
Madison	27.8	.4	1.5	3.9	1.2	6.5	1.0	2.8	2.8	1.0	.7	1.4	4
Marion	36.8	.1	4.8	7.8	2.4	4.1	1.7	2.6	3.3	1.5	1.1	1.4	6
Marshall	71.0	.2	11.5	17.0	5.7	6.1	2.8	3.0	5.0	2.4	2.1	5.2	10

(Million board feet) 1/

Table 40 (Continued)

Species	All species	Soft-woods	White oak group	Red oak group	Hickory	Hard maple	Soft maple	Beech	Ash	Cotton-wood	Yellow-poplar	Sycamore	Other hard-woods
artin	335.8	5.8	53.5	88.4	49.2	14.6	14.3	3.7	14.0	2.5	32.0	17.1	40.7
Miami	49.5	-	7.9	10.8	3.8	5.6	2.3	2.5	3.8	2.2	1.7	3.1	5.8
Monroe	402.4	4.3	104.9	110.4	45.5	24.1	3.1	19.3	12.5	2.4	27.5	16.3	32.1
Montgomery	52.6	-	9.6	14.0	4.6	3.2	2.2	1.8	3.3	2.1	2.9	1.8	7.1
Morgan	269.5	3.1	70.2	72.2	29.9	17.5	2.4	11.9	8.4	1.5	16.4	12.8	23.2
Newton	36.1	-	6.0	9.2	2.7	2.0	1.8	.7	3.3	1.1	1.3	2.1	5.9
Noble	58.9	.1	10.2	14.9	4.8	5.0	2.3	2.7	3.8	5.3	1.9	1.1	6.8
Ohio	24.6	-	4.9	5.1	2.7	4.2	1.0	2.3	.9	-	1.8	-	1.7
Orange	316.4	4.7	73.3	77.1	35.5	21.2	2.4	18.2	9.4	5.8	20.0	21.2	27.6
Owen	347.2	3.6	93.6	96.6	39.2	20.7	2.9	17.1	10.1	1.4	21.0	13.2	27.8
Parke	235.5	5.7	36.0	57.0	32.4	8.7	12.6	2.2	11.3	3.7	23.1	11.9	30.9
Perry	450.1	11.3	117.6	123.6	50.7	26.7	3.8	23.7	14.0	2.4	26.9	15.0	34.4
Pike	144.0	3.1	19.5	29.6	20.5	5.3	9.5	1.0	7.5	3.3	10.4	11.0	23.3
Porter	64.0	-	10.6	14.8	5.4	4.5	3.4	2.7	4.9	2.1	2.7	2.4	10.5
Posey	137.0	11.3	18.5	26.5	17.2	4.4	7.2	1.4	6.3	3.7	9.6	11.7	19.2
Pulaski	59.3	-	10.3	12.6	4.6	7.1	2.2	2.2	4.5	2.6	2.4	2.6	8.2
Putnam	212.2	11.4	32.6	48.9	31.5	9.4	10.9	2.1	9.3	2.2	18.6	10.5	24.8
Randolph	42.2	-	6.1	10.3	2.7	5.0	2.0	2.2	3.1	3.3	1.3	1.3	4.9
Ripley	98.2	-	20.6	20.2	10.3	10.6	5.0	8.0	4.8	.8	7.4	1.4	9.1
Rush	35.7	-	4.4	5.3	2.2	4.9	1.7	1.8	3.0	3.4	1.0	1.9	6.1
St. Joseph	58.0	.2	9.9	13.7	4.1	3.6	3.1	2.2	4.6	4.2	1.9	2.5	8.0
Scott	154.2	.9	38.4	39.8	16.6	9.6	1.2	7.9	4.8	3.0	9.5	10.0	12.5
Shelby	28.5	.5	1.5	4.0	1.7	4.0	1.2	1.5	3.1	3.0	.6	1.3	6.1
Spencer	203.2	3.0	39.1	43.8	27.3	15.6	1.9	14.0	7.7	3.2	12.1	13.2	22.3
Starke	68.4	.1	9.5	16.1	4.8	5.7	2.3	2.2	3.9	11.3	2.7	1.6	8.2
Steuben	54.1	.4	6.9	13.2	4.2	4.8	2.1	2.8	3.5	7.3	1.7	1.1	6.1
Sullivan	147.0	5.7	20.1	28.6	22.8	5.2	11.9	1.8	6.4	3.6	10.1	8.0	22.8
Switzerland	42.9	-	9.8	11.1	3.7	2.6	1.9	4.0	1.6	-	3.9	.6	3.7
Tippecanoe	40.4	.2	6.8	8.7	3.1	4.6	2.0	2.2	2.8	.4	1.7	1.3	6.6
Tipton	17.3	-	1.9	3.6	1.2	1.9	1.3	.7	1.1	2.7	.3	.9	1.7
Union	27.4	-	5.5	5.4	2.7	2.8	1.6	2.5	1.2	.7	1.6	.6	2.8
Vanderburgh	60.0	2.8	8.0	12.2	7.9	3.3	3.8	.6	2.9	1.6	5.2	3.6	8.1
Vermillion	118.7	14.1	14.9	21.6	14.7	5.0	8.1	1.1	5.0	1.5	7.5	8.6	16.6
Vigo	128.9	5.7	17.1	27.1	19.1	4.6	7.8	1.3	5.9	3.4	9.3	8.3	19.3
Wabash	56.0	.2	7.6	11.3	3.9	3.8	3.1	2.0	4.4	6.1	2.1	3.2	8.3
Warren	62.0	.1	8.9	12.7	4.7	5.2	2.7	2.8	3.8	5.4	2.7	5.4	7.6
Warrick	163.0	1.0	34.7	36.5	22.8	11.1	1.7	8.4	4.7	2.3	10.6	11.1	18.1
Washington	465.2	4.6	119.4	123.5	56.1	31.2	4.4	28.0	14.7	1.9	26.2	15.0	40.2
Wayne	53.0	.2	7.6	11.9	3.6	4.6	1.8	2.3	4.3	2.3	2.1	2.9	9.4
Wells	54.4	-	7.6	10.7	3.9	4.3	3.5	2.4	3.9	5.0	1.7	4.8	6.6
White	31.2	-	7.4	9.3	3.0	2.3	.9	.6	1.7	.2	1.4	.9	3.5
Whitley	50.8	-	8.2	11.3	3.6	4.4	2.6	2.3	3.9	4.0	1.7	1.2	7.6
All counties	10,885.4	167.9	2,207.6	2,629.6	1,201.6	751.5	330.5	490.9	485.9	279.2	650.8	504.9	1,185.0

1/ International 1/4-inch rule.

Table 41.--*Net volume of growing stock and sawtimber on commercial forest land, by counties and kind of material, Indiana, 1967*

County	Growing stock			Sawtimber		
	Total	Poletimber trees	Sawtimber trees	Total	In sawtimber stands	In other stands
	Million cubic feet	Million cubic feet	Million cubic feet	Million 1/ board feet	Million 1/ board feet	Million 1/ board feet
Adams	13.6	3.5	10.1	45.0	41.8	3.2
Allen	30.2	8.3	21.9	97.4	88.0	9.4
Bartholomew	33.4	7.8	25.6	114.3	105.4	8.9
Benton	0.8	0.4	0.4	1.7	0.6	1.1
Blackford	6.3	1.4	4.9	21.5	19.9	1.6
Boone	6.1	1.9	4.2	18.7	15.6	3.1
Brown	144.1	47.6	96.5	462.6	404.7	57.9
Carroll	11.8	3.7	8.1	35.4	29.8	5.6
Cass	17.1	4.4	12.7	56.1	51.8	4.3
Clark	93.9	34.2	59.7	285.3	230.0	55.3
Clay	47.5	15.8	31.7	141.0	121.1	19.9
Clinton	6.9	1.7	5.2	22.6	20.3	2.3
Crawford	103.7	39.1	64.6	307.1	239.5	67.6
Daviess	39.0	13.3	25.7	112.4	94.1	18.3
Dearborn	23.0	5.9	17.1	73.4	70.8	2.6
Decatur	21.8	5.8	16.0	71.7	65.1	6.6
De Kalb	18.7	5.1	13.6	60.8	55.0	5.8
Delaware	10.4	2.8	7.6	34.0	30.8	3.2
Dubois	100.8	31.7	69.1	330.2	293.2	37.0
Elkhart	18.4	4.8	13.6	60.6	54.3	6.3
Fayette	12.7	3.4	9.3	40.1	39.1	1.0
Floyd	38.8	13.2	25.6	122.9	104.3	18.6
Fountain	25.7	6.5	19.2	84.4	78.0	6.4
Franklin	42.5	12.0	30.5	131.8	126.1	5.7
Fulton	14.3	3.6	10.7	47.4	43.3	4.1
Gibson	48.6	14.4	34.2	151.6	135.8	15.8
Grant	10.8	2.4	8.4	36.3	33.8	2.5
Greene	88.1	31.7	56.4	245.3	204.7	40.6
Hamilton	11.2	2.5	8.7	38.4	35.9	2.5
Hancock	6.0	1.4	4.6	20.4	18.6	1.8
Harrison	122.0	42.2	79.8	380.8	324.7	56.1
Hendricks	12.3	3.7	8.6	38.2	33.1	5.1
Henry	12.1	3.3	8.8	38.6	33.5	5.1
Howard	5.9	1.7	4.2	18.6	17.2	1.4
Huntington	15.9	4.5	11.4	50.1	43.4	6.7
Jackson	118.7	40.3	78.4	372.1	316.2	55.9
Jasper	18.3	5.6	12.7	55.7	46.9	8.8
Jay	18.2	4.0	14.2	63.0	59.9	3.1
Jefferson	42.5	13.3	29.2	126.2	119.0	7.2
Jennings	56.6	15.9	40.7	175.5	167.5	8.0
Johnson	10.5	2.7	7.8	35.4	33.0	2.4
Knox	34.2	11.1	23.1	102.1	86.3	15.8
Kosciusko	22.4	5.7	16.7	74.0	66.9	7.1
Lagrange	13.9	3.7	10.2	45.2	40.3	4.9
Lake	8.5	1.8	6.7	29.4	27.3	2.1
La Porte	21.5	6.3	15.2	67.2	61.6	5.6
Lawrence	111.0	36.8	74.2	350.9	300.4	50.5
Madison	8.2	1.9	6.3	27.8	26.0	1.8
Marion	11.1	2.9	8.2	36.8	33.5	3.3
Marshall	21.2	5.3	15.9	71.0	66.0	5.0
Martin	113.0	37.1	75.9	335.8	294.1	41.7
Miami	15.3	4.2	11.1	49.5	43.5	6.0
Monroe	132.5	47.8	84.7	402.4	330.6	71.8
Montgomery	18.0	6.1	11.9	52.6	43.5	9.1
Morgan	88.3	31.4	56.9	269.5	220.2	49.3
Newton	12.0	3.8	8.2	36.1	30.9	5.2
Noble	18.7	5.4	13.3	58.9	52.2	6.7
Ohio	8.3	2.6	5.7	24.6	23.2	1.4
Orange	105.5	38.5	67.0	316.4	258.4	58.0
Owen	113.0	40.0	73.0	347.2	285.1	62.1
Parke	81.4	28.2	53.2	235.5	202.7	32.8
Perry	146.3	52.1	94.2	450.1	372.7	77.4
Pike	52.3	19.3	33.0	144.0	115.6	28.4
Porter	20.9	6.4	14.5	64.0	54.3	9.7
Posey	43.0	12.7	30.3	137.0	124.2	12.8
Pulaski	19.1	5.8	13.3	59.3	50.8	8.5
Putnam	69.7	22.3	47.4	212.2	185.4	26.8
Randolph	12.6	3.1	9.5	42.2	38.6	3.6
Ripley	32.4	9.6	22.8	98.2	92.6	5.6
Rush	10.5	2.4	8.1	35.7	32.7	3.0
St. Joseph	18.3	5.3	13.0	58.0	50.9	7.1
Scott	47.7	15.5	32.2	154.2	134.8	19.4
Shelby	8.6	2.1	6.5	28.5	26.7	1.8
Spencer	62.3	19.6	42.7	203.2	178.9	24.3
Starke	21.8	6.2	15.6	68.4	59.8	8.6
Steuben	17.0	4.8	12.2	54.1	47.7	6.4
Sullivan	49.8	16.5	33.3	147.0	124.1	22.9
Switzerland	15.9	5.7	10.2	42.9	37.3	5.6
Tippecanoe	13.4	4.1	9.3	40.4	35.3	5.1
Tipton	5.1	1.1	4.0	17.3	16.5	.8
Union	8.8	2.4	6.4	27.4	26.1	1.3
Vanderburgh	19.5	6.0	13.5	60.0	54.0	6.0
Vermillion	37.2	11.3	25.9	118.7	107.2	11.5
Vigo	42.9	13.7	29.2	128.9	111.1	17.8
Wabash	17.2	4.7	12.5	56.0	50.3	5.7
Warren	19.1	5.3	13.8	62.0	56.0	6.0
Warrick	53.7	19.2	34.5	163.0	127.3	35.7
Washington	142.5	45.4	97.1	465.2	413.6	51.6
Wayne	16.8	4.8	12.0	53.0	45.7	7.3
Wells	16.1	4.0	12.1	54.4	50.4	4.0
White	9.6	2.5	7.1	31.2	27.4	3.8
Whitley	15.7	4.2	11.5	50.8	44.9	5.9
All counties	3,503.0	1,126.2	2,376.8	10,885.4	9,429.0	1,456.4

(Continued on next page)

Table 42. — *Net annual growth and removals of growing stock on commercial forest land, by species, Indiana, 1966*

(Thousand cubic feet)

Species	Net annual growth	Annual timber removals
Softwoods:		
Shortleaf and loblolly pine	422	84
Other yellow pines	725	58
Cypress	17	164
Other softwoods	2,211	94
Total softwoods	3,375	400
Hardwoods:		
White oak	8,103	5,541
Other select white oaks	731	1,515
Select red oak	7,762	5,998
Other white oaks	979	1,193
Black oak	7,383	6,844
Other red oaks	3,945	3,598
Hickory	7,335	3,485
Hard maple	6,636	5,238
Soft maple	6,387	4,613
Beech	1,740	3,588
Sweetgum	493	1,515
Tupelo and blackgum	911	571
Ash	8,624	3,500
Cottonwood	2,649	4,258
Aspen	1,666	253
Basswood	639	753
Yellow-poplar	9,193	3,902
Black walnut	2,524	2,810
Black cherry	1,537	424
Elm	341	675
Sycamore	5,821	2,988
Other hardwoods	6,300	1,238
Total hardwoods	91,699	64,500
All species	95,074	64,900

Table 43. — *Net annual growth and removals of growing stock on commercial forest land, by ownership classes and by softwoods and hardwoods, Indiana, 1966*

(Thousand cubic feet)

Ownership class	Net annual growth			Annual removals		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
National Forest	4,417	363	4,054	376	-	376
Other public	4,448	299	4,149	386	10	376
Forest industry	517	20	497	738	-	738
Farmer and miscellaneous private	85,692	2,693	82,999	63,400	390	63,010
All ownerships	95,074	3,375	91,699	64,900	400	64,500

Table 44. — *Net annual growth and removals of sawtimber on commercial forest land, by species, Indiana, 1966*
(Thousand board feet)[1]

Species	Net annual growth	Annual timber removals
Softwoods:		
Shortleaf and loblolly pine	101	89
Other yellow pines	4,044	208
Cypress	109	607
Other softwoods	3,342	96
Total softwoods	7,596	1,000
Hardwoods:		
White oak	26,838	29,818
Other select white oaks	1,533	7,926
Select red oak	26,804	33,206
Other white oaks	1,689	6,315
Black oak	21,753	37,306
Other red oaks	9,853	16,283
Hickory	11,586	15,479
Hard maple	13,305	31,517
Soft maple	8,284	21,838
Beech	3,874	18,252
Sweetgum	1,034	5,902
Tupelo and blackgum	1,499	2,965
Ash	12,256	18,886
Cottonwood	11,787	20,481
Aspen	3,189	1,131
Basswood	1,537	4,837
Yellow-poplar	33,412	24,625
Black walnut	3,985	17,782
Black cherry	2,560	2,782
Elm	-5,012	4,014
Sycamore	19,087	16,870
Other hardwoods	7,397	5,822
Total hardwoods	218,250	344,037
All species	225,846	345,037

[1] International 1/4-inch rule.

Table 45. — *Net annual growth and removals of sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Indiana, 1966*
(Thousand board feet)[1]

Ownership class	Net annual growth			Annual removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
National Forest	6,311	114	6,197	2,278	-	2,278
Other public	8,009	370	7,639	2,266	9	2,257
Forest industry	1,235	42	1,193	4,191	-	4,191
Farmer and miscellaneous private	210,291	7,070	203,221	336,302	991	335,311
All ownerships	225,846	7,596	218,250	345,037	1,000	344,037

[1] International 1/4-inch rule.

Table 46.—*Net annual growth of growing stock on commercial forest land, by species and Forest Survey Units, Indiana, 1966*
(Thousand cubic feet)

Species	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	422	32	385	-	5
Other yellow pines	725	148	564	-	13
Cypress	17	17	-	-	-
Other softwoods	2,211	312	1,127	2	770
Total softwoods	3,375	509	2,076	2	788
Hardwoods:					
White oak	8,103	965	4,182	546	2,410
Other select white oaks	731	106	198	71	356
Select red oak	7,762	1,305	3,375	511	2,571
Other white oaks	979	22	928	4	25
Black oak	7,383	1,063	4,384	369	1,567
Other red oaks	3,945	716	764	47	2,418
Hickory	7,335	1,471	2,170	533	3,161
Hard maple	6,636	753	3,472	454	1,957
Soft maple	6,387	2,060	1,286	204	2,837
Beech	1,740	-28	1,153	-156	771
Sweetgum	493	142	421	-147	77
Tupelo and blackgum	911	255	532	74	50
Ash	8,624	1,631	2,228	230	4,535
Cottonwood	2,649	168	485	25	1,971
Aspen	1,666	71	307	372	916
Basswood	639	49	103	10	477
Yellow-poplar	9,193	2,605	4,643	311	1,634
Black walnut	2,524	814	820	173	717
Black cherry	1,537	145	451	-17	958
Elm	341	-552	314	-357	936
Sycamore	5,821	952	2,838	174	1,857
Other hardwoods	6,300	2,332	2,118	232	1,618
Total hardwoods	91,699	17,045	37,172	3,663	33,819
All species	95,074	17,554	39,248	3,665	34,607

Table 47.—*Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Units, Indiana, 1966*
(Thousand board feet)[1]

Species	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	101	-	101	-	-
Other yellow pines	4,044	-	4,044	-	-
Cypress	109	109	-	-	-
Other softwoods	3,342	77	153	2	3,110
Total softwoods	7,596	186	4,298	2	3,110
Hardwoods:					
White oak	26,838	2,030	14,280	816	9,712
Other select white oaks	1,533	488	432	10	603
Select red oak	26,804	4,680	8,772	2,780	10,572
Other white oaks	1,689	101	1,631	14	-57
Black oak	21,753	4,344	12,606	350	4,453
Other red oaks	9,853	2,226	1,756	127	5,744
Hickory	11,586	680	4,650	356	5,900
Hard maple	13,305	421	4,838	70	7,976
Soft maple	8,284	1,369	716	1,137	5,062
Beech	3,874	-243	2,298	-819	2,638
Sweetgum	1,034	-175	965	115	129
Tupelo and blackgum	1,499	252	723	469	55
Ash	12,256	2,860	1,985	201	7,210
Cottonwood	11,787	654	1,530	88	9,515
Aspen	3,189	116	205	107	2,761
Basswood	1,537	216	488	23	810
Yellow-poplar	33,412	10,910	13,097	1,177	8,228
Black walnut	3,985	654	2,117	64	1,150
Black cherry	2,560	123	1,796	56	585
Elm	-5,012	-3,504	-1,362	-2,176	2,030
Sycamore	19,087	4,221	10,223	130	4,513
Other hardwoods	7,397	1,683	3,248	53	2,413
Total hardwoods	218,250	34,106	86,994	5,148	92,002
All species	225,846	34,292	91,292	5,150	95,112

[1] International 1/4-inch rule.

Table 48. — *Annual timber removals from growing stock on commercial forest land, by items and by softwoods and hardwoods, Indiana, 1966*

(Thousand cubic feet)

Item	All species	Soft- woods	Hard- woods
Roundwood products:			
Saw logs	32,104	133	31,971
Veneer logs and bolts	2,049	-	2,049
Pulpwood	6,776	50	6,726
Cooperage logs and bolts	834	-	834
Mine timbers	93	-	93
Posts	139	44	95
Other	2,623	-	2,623
Fuelwood	3,098	-	3,098
All products	47,716	227	47,489
Logging residues	10,316	15	10,301
Other removals	6,868	158	6,710
Total removals	64,900	400	64,500

Table 49. — *Annual timber removals from live timber on commercial forest land items and by softwoods and hardw Indiana, 1966*

(Thousand board feet)[1]

Item	All species	Soft- woods	Hard woo
Roundwood products:			
Saw logs	219,154	670	218,4
Veneer logs and bolts	15,375	-	15,3
Pulpwood	4,831	69	4,7
Cooperage logs and bolts	5,312	-	5,3
Mine timbers	183	-	1
Posts	116	17	
Other	13,489	-	13,4
Fuelwood	6,160	-	6,1
All products	264,620	756	263,8
Logging residues	44,414	18	44,3
Other removals	36,003	226	35,7
Total removals	345,037	1,000	344,0

1/ International 1/4-inch rule.

Table 50. — *Annual timber removals from growing stock on commercial forest land, by species and Forest Survey Units, Indiana, 1966*

(Thousand cubic feet)

Species	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	84	67	7	10	-
Other yellow pines	58	-	56	2	-
Cypress	164	162	2	-	-
Other softwoods	94	18	35	34	7
Total softwoods	400	247	100	46	7
Hardwoods:					
White oak	5,541	998	2,186	801	1,556
Other select white oaks	1,515	161	76	66	1,212
Select red oak	5,998	1,131	1,983	700	2,184
Other white oaks	1,193	36	584	-	573
Black oak	6,844	1,172	3,547	179	1,946
Other red oaks	3,598	1,105	934	764	795
Hickory	3,485	854	1,190	413	1,028
Hard maple	5,238	536	1,209	398	3,095
Soft maple	4,613	1,691	1,069	284	1,569
Beech	3,588	429	1,251	809	1,099
Sweetgum	1,515	534	595	297	89
Tupelo and blackgum	571	155	361	48	7
Ash	3,500	756	829	512	1,403
Cottonwood	4,258	2,277	612	282	1,087
Aspen	253	52	125	27	49
Basswood	753	80	63	29	581
Yellow-poplar	3,902	1,113	1,683	373	733
Black walnut	2,810	342	704	443	1,321
Black cherry	424	81	95	31	217
Elm	675	186	192	31	266
Sycamore	2,988	781	949	406	852
Other hardwoods	1,238	624	256	61	297
Total hardwoods	64,500	15,094	20,493	6,954	21,959
All species	64,900	15,341	20,593	7,000	21,966

Table 51. — *Annual timber removals from live sawtimber on commercial forest land, by species and Forest Survey Units, Indiana, 1966*

(Thousand board feet)[1]

Species	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	89	71	8	10	-
Other yellow pines	208	-	200	8	-
Cypress	607	607	-	-	-
Other softwoods	96	5	40	48	3
Total softwoods	1,000	683	248	66	3
Hardwoods:					
White oak	29,818	5,677	12,285	3,642	8,214
Other select white oaks	7,926	897	413	299	6,317
Northern red oak	33,206	6,855	11,114	2,991	12,246
Other white oaks	6,315	151	3,186	-	2,978
Black oak	37,306	5,722	19,960	763	10,861
Other red oaks	16,283	3,664	5,012	3,281	4,326
Hickory	15,479	4,138	5,451	1,393	4,497
Hard maple	31,517	3,404	7,000	1,132	19,981
Soft maple	21,838	6,181	5,375	834	9,448
Beech	18,252	2,691	7,077	2,481	6,003
Sweetgum	5,902	1,705	3,035	911	251
Tupelo and blackgum	2,965	883	1,857	191	34
Ash	18,886	4,233	4,433	1,857	8,363
Cottonwood	20,481	10,104	2,832	904	6,641
Aspen	1,131	278	572	95	186
Basswood	4,837	511	391	185	3,750
Yellow-poplar	24,625	7,118	10,732	1,950	4,825
Black walnut	17,782	2,136	4,410	2,796	8,440
Black cherry	2,782	528	615	219	1,420
Elm	4,014	989	1,113	191	1,721
Sycamore	16,870	4,648	5,264	1,691	5,267
Other hardwoods	5,822	3,223	1,119	237	1,243
Total hardwoods	344,037	75,736	113,246	28,043	127,012
All species	345,037	76,419	113,494	28,109	127,015

[1] International 1/4-inch rule.

Table 52. *Output of timber products, by source of material and by softwoods and hardwoods, Indiana, 1966*

Product and species group	Standard units	Total output: Number of std. units	Total output: Thousand cu. ft.	Roundwood products: Number of std. units	Roundwood products: Thousand cu. ft.	Plant byproducts: Number of std. units	Plant byproducts: Thousand cu. ft.
Saw logs:	M bd. ft.1/						
Softwood		783	140	783	140	-	-
Hardwood		222,523	32,611	222,523	32,611	-	
Total		223,306	32,751	223,306	32,751	-	-
Veneer logs and bolts:	M bd. ft.1/						
Hardwood		16,258	2,173	16,258	2,173	-	-
Pulpwood:	Std.cords2/						
Softwood		662	51	662	51	-	-
Hardwood		95,778	6,895	93,431	6,726	2,347	169
Total		96,440	6,946	94,093	6,777	2,347	169
Cooperage:	M bd. ft.1/						
Hardwood		5,312	834	5,312	834	-	-
Total		5,312	834	5,312	834	-	-
Mine timbers (round):	M cu. ft.						
Hardwood		96	96	96	96	-	-
Total		96	96	96	96	-	-
Posts (round and split):	M pieces						
Softwood		41	44	41	44	-	-
Hardwood		156	200	156	200	-	-
Total		197	244	197	244	-	-
Other:3/	M cu. ft.						
Softwood		4	4	-	-	4	4
Hardwood		6,371	6,371	2,679	2,679	3,692	3,692
Total		6,375	6,375	2,679	2,679	3,696	3,696
Total industrial products:							
Softwood		-	239	-	235	-	4
Hardwood		-	49,180	-	45,319	-	3,861
Total		-	49,419	-	45,554	-	3,865
Fuelwood:	Std.cords						
Softwood		40	3	-	-	40	3
Hardwood		163,000	10,936	81,821	5,497	81,179	5,439
Total		163,040	10,939	81,821	5,497	81,219	5,442
All products:							
Softwood		-	242	-	235	-	7
Hardwood		-	60,116	-	50,816	-	9,300
Total		-	60,358	-	51,051	-	9,307

1/ International 1/4-inch rule.

2/ Rough-wood basis (includes chips converted to equivalent standard cord).

3/ Includes particleboard bolts, excelsior bolts, shavings bolts, livestock bedding, and soil conditioner.

Table 53.—*Output of roundwood products, by source and by softwoods and hardwoods, Indiana, 1966*
(Thousand cubic feet)

Products and species group	All sources	Growing-stock trees[1]			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
Industrial products:							
Saw logs:							
Softwood	140	133	124	9	-		-
Hardwood	32,611	31,971	31,936	35	209	214	217
Total	32,751	32,104	32,060	44	209	221	217
Veneer logs and bolts:							
Hardwood	2,173	2,049	2,049	-		-	124
Total	2,173	2,049	2,049	-		-	124
Pulpwood:							
Softwood	51	50	14	36	1	-	
Hardwood	6,726	6,726	821	5,905	-		
Total	6,777	6,776	835	5,941	1		-
Miscellaneous industrial products:							
Cooperage:							
Hardwood	834	834	834	-	-	-	-
Total	834	834	834	-		-	
Mine timbers (round):							
Hardwood	96	93	36	57	-	-	3
Total	96	93	36	57	-	-	3
Posts (round and split):							
Softwood	44	44	3	41	-	-	-
Hardwood	200	95	24	71			105
Total	244	139	27	112	-	-	105
Other:							
Hardwood	2,679	2,623	1,929	694	56	-	-
Total	2,679	2,623	1,929	694	56	-	
All miscellaneous industrial products:							
Softwood	44	44	3	41	-	-	-
Hardwood	3,809	3,645	2,823	822	56		108
Total	3,853	3,689	2,826	863	56	-	108
Fuelwood:							
Hardwood	5,497	3,098	1,240	1,858	40	205	2,154
Total	5,497	3,098	1,240	1,858	40	205	2,154
All products:							
Softwood	235	227	141	86		7	-
Hardwood	50,816	47,489	38,869	8,620	305	419	2,603
Total	51,051	47,716	39,010	8,706	306	426	2,603

[1] On commercial forest land.

[2] Includes noncommercial forest land, nonforest land (such as fence rows), trees less than 5.0 inches in diameter and limbwood.

Table 54.—*Volume of unused residues of primary manufacturing plants, by industry, type of residue, and softwoods and hardwoods, Indiana, 1966*

(Thousand cubic feet)

Species group and type of residues	All industries	Lumber	Veneer and plywood	Other
Softwoods:				
Coarse 1/	10	10	-	-
Fine 2/	6	6	-	-
Total	16	16	-	-
Hardwoods:				
Coarse 1/	5,798	5,438	129	231
Fine 2/	2,623	2,156	233	234
Total	8,421	7,594	362	465
All species:				
Coarse 1/	5,808	5,448	129	231
Fine 2/	2,629	2,162	233	234
Total	8,437	7,610	362	465

1/ Includes slabs, edgings, and veneer cores.
2/ Includes sawdust and shavings.

Table 55.—*A comparison of the number of primary wood-using plants operating in 1961 and 1966, by Forest Survey Units, Indiana*

(Number of plants)

Kind of plant 1/	All units		Lower Wabash Unit		Knobs Unit		Upland Flats Unit		Northern Unit	
	1961	1966	1961	1966	1961	1966	1961	1966	1961	1966
Sawmills:										
Large 2/	(3/)	86	(3/)	16	(3/)	25	(3/)	4	(3/)	41
Medium 4/	(3/)	55	(3/)	4	(3/)	22	(3/)	2	(3/)	27
Small	(3/)	339	(3/)	41	(3/)	183	(3/)	43	(3/)	72
Total 5/	400	480	63	61	139	230	63	49	135	140
Veneer mills:										
Std. grade	17	18	1	1	5	6	2	2	9	9
Container	2	3	-	1	1	1	-	-	1	1
Total	19	21	1	2	6	7	2	2	10	10
Cooperage mills	10	7	3	2	3	3	2	1	2	1
Handle plants	7	4	1	1	3	2	-	-	3	1
Pulpmills	3	2	1	1	-	-	-	-	2	1
Charcoal plants	-	-	-	-	-	-	-	-	-	-
Misc. plants 6/	5	4	-	1	3	2	1	-	1	1
Grand total	444	518	69	68	154	244	68	52	153	154

1/ Excludes idle mills.
2/ Annual lumber output in excess of 1 million board feet.
3/ Data not available by mill size.
4/ Annual lumber output from 1/2 million to 1 million board feet.
5/ Sawmill totals for 1961 do not include a number of small sawmills.
6/ Includes excelsior plants.

ble 56. — *Value of timber products[1] to producer, by Forest Survey Units, Indiana, 1966*
(Thousand dollars)

Survey Unit	All products	Product: Lumber logs	Product: Veneer logs	Product: All others
wer Wabash Unit	3,335	1,930	540	865
obs Unit	4,795	2,805	805	1,185
land Flats Unit	1,870	725	550	595
rthern Unit	7,005	4,035	2,320	650
All Units	17,005	9,495	4,215	3,295

1/ Value delivered to the mill.

able 57. — *Annual mortality of growing stock and sawtimber on commercial forest land, by species, Indiana, 1966*

Species	Growing stock Thousand cubic feet	Sawtimber Thousand board feet 1/
oftwoods:		
Shortleaf and loblolly pine	-	-
Other yellow pines	75	120
Cypress	-	-
Other softwoods	72	-
Total softwoods	147	120
ardwoods:		
White oak	427	965
Other select white oak	436	1,721
Select red oak	829	2,146
Other white oak	335	675
Black oak	1,013	2,623
Other red oak	224	688
Hickory	836	1,221
Hard maple	530	1,393
Soft maple	209	661
Beech	692	2,926
Sweetgum	375	749
Tupelo and blackgum	87	387
Ash	546	1,053
Cottonwood	195	701
Aspen	130	-
Basswood	-	-
Yellow-poplar	-	-
Black walnut	477	1,090
Black cherry	274	739
Elm	2,677	9,791
Sycamore	182	440
Other hardwoods	1,068	1,217
Total hardwoods	11,542	31,186
All species	11,689	31,306

1/ International 1/4-inch rule.

Table 58. — *Annual mortality of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, Indiana, 1966*

Ownership class	Growing stock (Thousand cubic feet): All species	Soft-woods	Hard-woods	Sawtimber (Thousand board feet) 1/: All species	Soft-woods	Hard-woods
National Forest	406	-	406	352	-	352
Other public	732	-	732	2,243	-	2,243
Forest industry	54	-	54	112	-	112
Farmer and miscellaneous private	10,497	147	10,350	28,599	120	28,479
All ownerships	11,689	147	11,542	31,306	120	31,186

1/ International 1/4-inch rule.

Table 59. — *Annual mortality of growing stock and sawtimber on commercial forest land, by causes and by softwoods and hardwoods, Indiana, 1966*

Cause	Growing stock (Thousand cubic feet): All species	Soft-woods	Hard-woods	Sawtimber (Thousand board feet) 1/: All species	Soft-woods	Hard-woods
Fire	805	-	805	1,507	-	1,507
Insects	187	-	187	606	-	606
Disease	5,394	-	5,394	16,689	-	16,689
Other	3,093	147	2,946	6,990	120	6,870
Unknown	2,210	-	2,210	5,514	-	5,514
All causes	11,689	147	11,542	31,306	120	31,186

1/ International 1/4-inch rule.

Table 60.— *Annual allowable cut of growing stock on commercial forest land, by species and Forest Survey Units, Indiana, 1967*
(Thousand cubic feet)

[illegible]	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
[illegible]					
[illegible] and loblolly pine	17	-	17	-	-
[illegible] low pines	419	-	419	-	-
[illegible]	1,162	1,162	-	-	-
[illegible] softwoods	294	-	213	-	81
Total softwoods	1,892	1,162	649	-	81
Hardwoods:					
White oak	18,753	2,961	10,603	1,830	3,359
Other select white oaks	1,970	402	413	118	1,037
Select red oak	8,542	2,032	3,202	569	2,739
Other white oaks	4,712	209	4,281	72	150
Black oak	9,453	1,055	5,670	423	2,305
Other red oaks	2,529	205	1,140	464	720
Hickory	14,006	3,834	6,590	930	2,602
Hard maple	10,669	1,510	4,517	1,406	3,236
Soft maple	5,810	3,025	624	556	1,605
Beech	5,231	287	2,997	610	1,337
Sweetgum	1,242	497	373	318	54
Tupelo and blackgum	1,266	454	539	216	57
Ash	6,660	1,579	1,878	440	2,763
Cottonwood	2,100	476	226	92	1,306
Aspen	345	117	87	88	53
Basswood	947	79	119	114	635
Yellow-poplar	3,907	1,043	2,104	362	398
Black walnut	1,722	253	413	55	1,001
Black cherry	1,357	123	551	172	511
Elm	2,905	860	987	169	889
Sycamore	5,469	1,590	1,786	171	1,922
Other hardwoods	4,763	1,289	1,323	214	1,937
Total hardwoods	114,358	23,880	50,423	9,439	30,616
All species	116,250	25,042	51,072	9,439	30,697

Table 61.— *Annual allowable cut of live sawtimber on commercial forest land, by species and Forest Survey Units, Indiana, 1967*
(Thousand board feet)[1]

Species	All Units	Lower Wabash Unit	Knobs Unit	Upland Flats Unit	Northern Unit
Softwoods:					
Shortleaf and loblolly pine	9	-	9	-	-
Other yellow pines	1,464	-	1,464	-	-
Cypress	7,908	7,908	-	-	-
Other softwoods	996	-	720	-	276
Total softwoods	10,377	7,908	2,193	-	276
Hardwoods:					
White oak	68,741	10,771	37,315	7,219	13,436
Other select white oaks	7,986	1,583	1,473	383	4,547
Select red oak	36,996	8,564	14,213	2,399	11,820
Other white oaks	18,397	701	16,698	306	692
Black oak	40,953	4,356	25,095	1,352	10,150
Other red oaks	10,898	851	5,475	2,531	2,041
Hickory	44,836	13,649	19,894	3,033	8,260
Hard maple	30,524	3,833	11,790	3,350	11,551
Soft maple	18,576	9,254	1,969	2,306	5,047
Beech	20,559	838	12,109	2,024	5,588
Sweetgum	4,534	2,003	1,399	1,060	72
Tupelo and blackgum	5,037	1,708	2,077	1,061	191
Ash	19,831	3,830	5,899	1,230	8,872
Cottonwood	9,227	1,664	973	378	6,212
Aspen	822	495	131	168	28
Basswood	3,585	318	474	329	2,464
Yellow-poplar	16,921	4,590	9,308	1,488	1,535
Black walnut	5,334	704	1,420	69	3,141
Black cherry	4,148	420	1,900	501	1,327
Elm	7,835	2,194	2,759	350	2,532
Sycamore	21,302	5,925	6,698	464	8,215
Other hardwoods	13,573	2,918	3,715	586	6,354
Total hardwoods	410,615	81,169	182,784	32,587	114,075
All species	420,992	89,077	184,977	32,587	114,351

1/ International 1/4-inch rule.

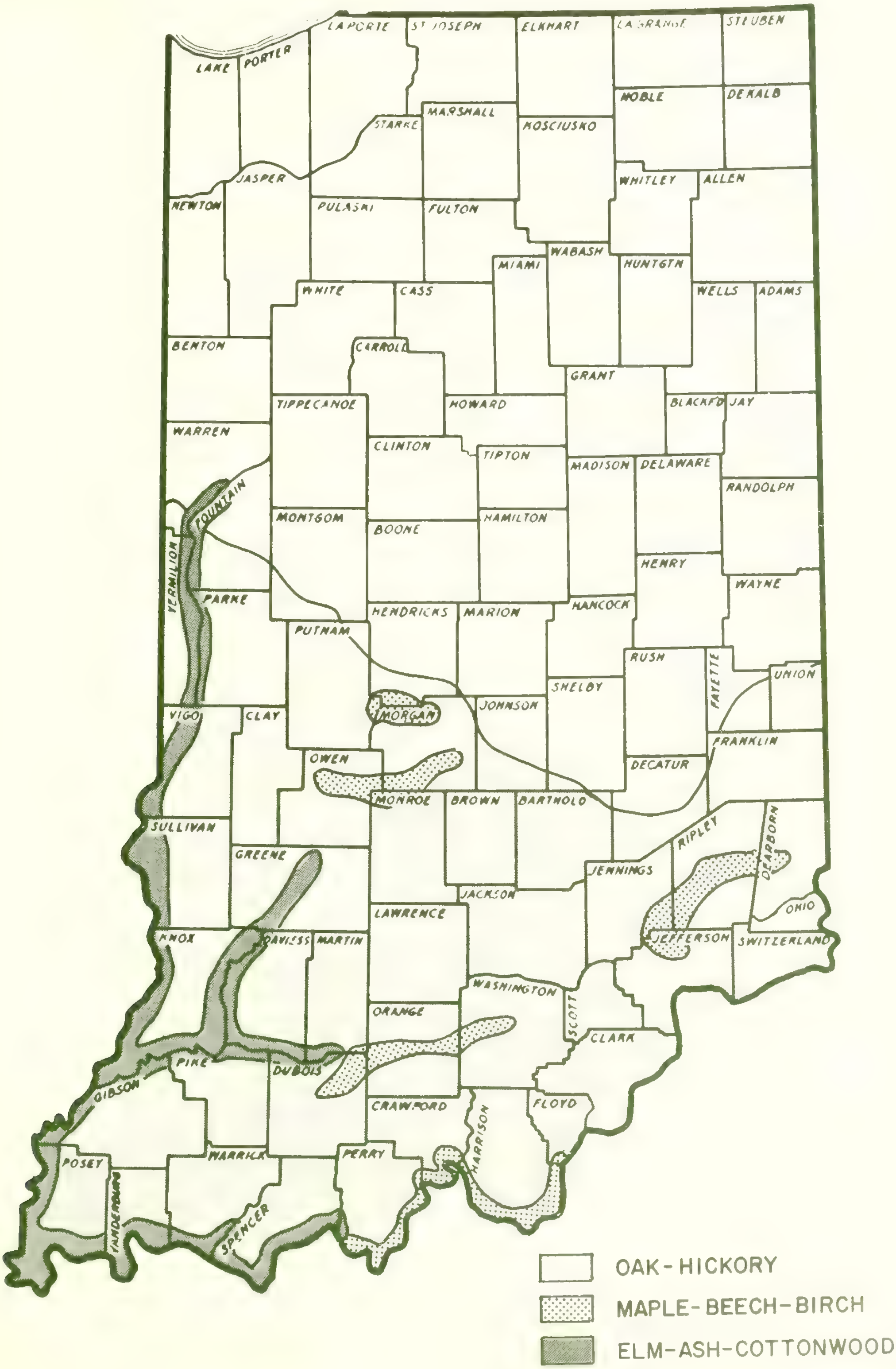
Table 62. — *Removals, net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Indiana, 1967, and projections*[1] *for 1977, 1987, and 1997*

Year	Removals			Growth			Inventory		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
GROWING STOCK									
(Million cubic feet)									
1967	64.9	0.4	64.5	95.1	3.4	91.7	3,502.9	60.8	3,442.1
1977	73.7	.6	73.1	101.6	6.8	94.8	3,784.2	106.2	3,678.0
1987	84.9	1.0	83.9	104.2	12.5	91.7	4,009.4	195.6	3,813.8
1997	102.3	1.7	100.6	123.5	19.1	104.4	4,175.0	325.3	3,849.7
SAWTIMBER									
(Million board feet) [2]									
1967	345.0	1.0	344.0	226.0	8.0	218.0	10,885.0	168.0	10,717.0
1977	352.0	2.0	350.0	167.0	11.0	156.0	9,360.0	242.0	9,118.0
1987	359.0	3.0	356.0	150.0	20.0	130.0	7,394.0	376.0	7,018.0
1997	366.0	4.0	362.0	174.0	34.0	140.0	5,360.0	582.0	4,778.0

[1] Based on the following assumptions: (a) that the area of commercial forest land will decline gradually to 3,040,000 acres by 1997; (b) that timber products output for the Nation and for Indiana will increase as a result of population gain and slight increases in per capita consumption; and (c) that the current trend in forest management and programs will continue.

[2] International 1/4-inch rule.

MAJOR FOREST TYPES, INDIANA, 1967
NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE



PREVIOUS REPORTS ON INDIANA'S FORESTS

The Forest Survey reports listed below show statistics of Indiana timber resources. These reports may be obtained by writing to the U.S.D.A. Forest Service, North Central Forest Experiment Station, Folwell Avenue, St. Paul, Minnesota 55101.

Pulpwood Production and Consumption in the North Central Region by County, 1965, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-2, 24 p., illus. 1966.

Pulpwood Production and Consumption in the North Central Region by County, 1966, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-3, 27 p., illus. 1967.

Indiana Sawmills Receive 232 Million Board Feet of Saw Logs in 1966, by James E. Blyth. U.S.D.A. Forest Serv. Res. Note NC-68, 4 p., illus. 1968.

Forest Land in Indiana Counties, 1967, by Burton L. Essex. U.S.D.A. Forest Serv. Res. Note NC-57, 4 p., illus. 1968.

Pulpwood Production and Consumption in the North Central Region by County, 1967, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-6, 23 p., illus. 1969.

Timber Volume in Indiana, 1967, by Arnold J. Ostrom. U.S.D.A. Forest Serv. Res. Note NC-58 (Rev.), 4 p., illus. 1969.

Veneer-Log Production and Consumption, North Central Region, 1966, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-5, 6 p., illus. 1968.

ABOUT THE FOREST SERVICE . . .

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U.S.D.A. FOREST SERVICE
RESOURCE BULLETIN NC-8
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PULPWOOD PRODUCTION in the NORTH CENTRAL REGION BY COUNTY

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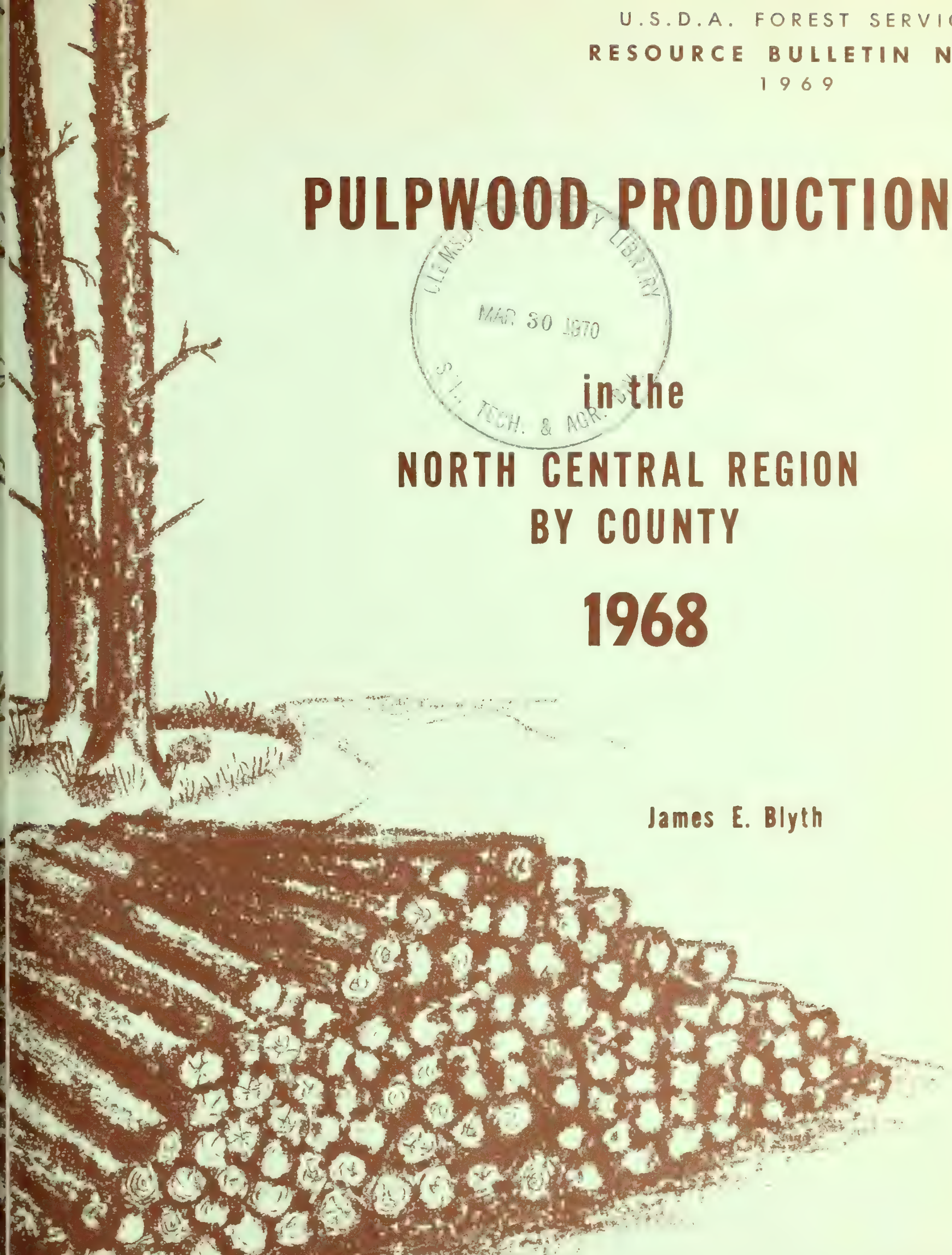

James E. Blyth

NORTH CENTRAL FOREST EXPERIMENT STATION
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Pulpwood Production In the North Central Region, By County, 1968

James E. Blyth

THE AUTHOR is a Market Analyst on the staff of the North Central Forest Experiment Station. He is headquartered at the Station's main office in St. Paul, Minnesota, which is maintained in cooperation with the University of Minnesota.

NORTH CENTRAL FOREST EXPERIMENT STATION
D. B. King, Director
FOREST SERVICE — U.S. DEPARTMENT OF AGRICULTURE
Folwell Avenue
St. Paul, Minnesota 55101

Pulpwood Production In the North Central Region, By County, 1968

James E. Blyth

This is the 10th annual report on the pulpwood harvest in Lake States counties and the ninth annual report on the Central States harvest. The Lake States and Central States are discussed separately because the timber types in each area are different and less information can be released about the Central States — more detailed data published on pulpwood production and consumption in the Central States would reveal the operations of individual mills.

The pulpmills using North Central States timber in 1968 reported their pulpwood receipts by State and county. Their cooperation is gratefully acknowledged. Thanks are due also to Ray Pfeifer, Staff Forester, Forest Resource Development, Michigan Department of Natural Resources, for collecting data on the Michigan pulpmills.

LAKE STATES

Pulpwood production and receipts dipped to the lowest level since 1962.[1] The primary reason for the small harvest was a substantial cutback in pulpwood inventories at several Wisconsin mills. Inventories were cut during 1968 to reduce overhead costs and to prevent wood quality deterioration in the wood yards.

Production Falls 10 Percent

Pulpwood production was 3,552,000 cords, 413,000 cords less than in 1967. All but 45,000 cords of local wood remained in the Lake States. Roundwood constituted 93 percent of the total production; the balance was residues from local wood-using plants. Lake States wood residues[2] received for pulping were up 44,000 cords from 1967. Four-fifths of the residues were delivered to pulpmills as chips.

Lake States roundwood production fell 457,000 cords in 1968, of which 224,000 cords were aspen, 105,000 cords were miscellaneous hardwoods, and 99,000 cords were spruce. Pine harvesting increased slightly.

Only 20 percent of the harvested roundwood was peeled before delivery, compared to 23 percent in 1967. Nearly all of the peeled wood was aspen. Loggers peeled half of the aspen cut in Wisconsin, more than one-third in Michigan, and nearly one-fifth in Minnesota (fig. 1). The proportion of peeled aspen varied greatly by Survey Unit in Michigan and Minnesota but was more uniform in Wisconsin.

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[1] *Pulpwood production is defined as the pulpwood volume from timber lands in a specified area that was received at all mills during 1968, whereas pulpwood receipts are defined as the volume of wood received by mills in a specified area regardless of the geographic source.*

[2] *Residues are by-products from sawmills, veneer mills, cooperage mills, and other wood-using plants that are used for pulping. Residues include slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from these by-products.*

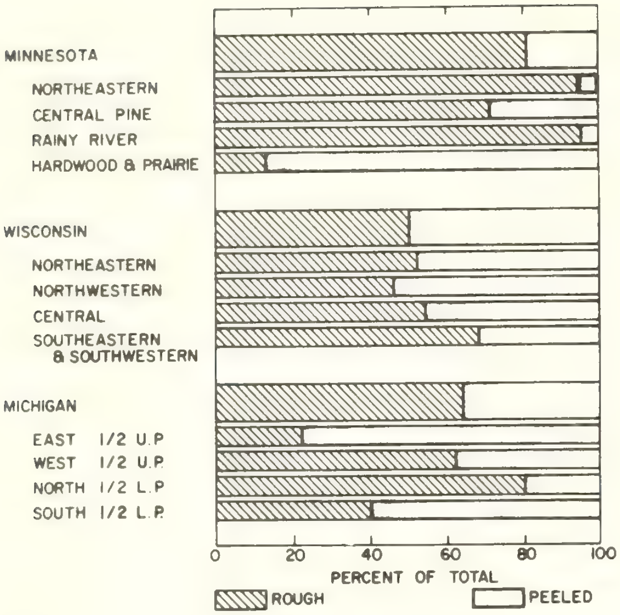

Figure 1. — Percent of rough and peeled aspen production of roundwood, by State and Forest Survey Unit, 1968.

Receipts Dip 467,000 Cords

The 46 Lake States plants received about 4 million cords of pulpwood in 1968, down 10 percent from 1967. Aspen and spruce deliveries fell sharply. All of the decline occurred in Wisconsin, where receipts plunged one-half million cords. Receipts remained steady in Michigan and were up 35,000 cords in Minnesota.

Of the 46 Lake States plants, 38 use aspen, 23 use spruce, and 20 use balsam fir (table 1).

Procurement of plant residues continued to climb and constituted 10 percent of the pulpwood shipments to regional mills in 1968, up 60,000 cords from 1967. Purchases of plant residues by Lake States mills rose each year from only 14,000 cords in 1960 to 197,000 cords in 1964, and to 392,000 cords in 1968.

The region is a large net importer of pulpwood (table 2). Wisconsin mills bought more than 70 percent of these imports with the remainder divided almost equally between Minnesota and Michigan. Canada supplied 166,000 cords of spruce roundwood and western States furnished 141,000 cords of softwood chips.

Table 1. — *Number of plants using the different species of wood for pulping in 1968*

Species and kind of material	Lake States	Minn.	Wis.	Mich.
Aspen	38	9	21	8
Balsam fir	20	5	11	4
Birch	9	1	8	--
Hemlock	6	--	5	1
Pine	12	3	5	4
Spruce	23	5	14	4
Tamarack	4	1	3	--
Misc. hardwoods	14	2	8	4
Wood chips	11	2	6	3
Slabwood and other residue	7	--	5	2
Total plants	46	9	27	10

Table 2. — *Pulpwood exports and imports for the Lake States, 1968*
(Thousand standard cords, unpeeled)

Species	Exports	Imports	Net imports
Aspen	2	13	11
Balsam fir	2	14	12
Pine	2	138	136
Spruce	19	166	147
Mixed hardwoods	5	6	1
Residues, softwood	7	141	134
Residues, hardwood	8	8	0
Total	45	486	441

Regional Active Mill Capacity Rises Slightly, Despite Closing of Three Mills

A new kraft pulpmill and increased capacity at several other mills more than offset the capacity lost due to the closing of three sulfite mills in the Lake States. Kraft mill capacity is now 2,175 tons per day (table 3), an increase of 485 tons from 1967. Based upon past wood use by type of process, the additional kraft mill capacity will tend to increase the use of pine in the Lake States, whereas the sulfite mill closings will tend to decrease the use of balsam fir and spruce.

Table 3.—*Active woodpulp mills in the Lake States, by location, type of pulp produced, and capacity, 1968*

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Minnesota:						
Blandin Paper Co.	Grand Rapids	205	--	--	205	--
Hennepin Paper Co.	Little Falls	65	--	--	65	--
Boise Cascade Corp.	International Falls	675	--	225	450	--
Northwest Paper Co., The	Cloquet	420	115	305	--	--
Nu-Ply Corp.	Bemidji	75	--	--	75	--
St. Regis Paper Co.	Sartell	125	--	--	125	--
Superwood Corp.	Duluth	240	--	--	240	--
Hoerner Waldorf Corp.	St. Paul	300	--	--	--	300
Conwed Corp.	Cloquet	350	--	--	350	--
Total	9 plants	2,455	115	530	1,510	300
Wisconsin:						
American Can Co.	Green Bay	235	145	--	90	--
American Can Co.	Rothschild	180	180	--	--	--
Badger Paper Mills, Inc.	Peshtigo	90	90	--	--	--
Combined Paper Mills, Inc.	Combined Locks	175	--	--	175	--
Consolidated Papers, Inc.	Appleton	155	155	--	--	--
Consolidated Papers, Inc.	Stevens Point	110	--	--	110	--
Consolidated Papers, Inc.	Wisconsin Rapids	645	--	350	295	--
Green Bay Packaging, Inc.	Green Bay	200	--	--	--	200
Kansas City Star Co.	Park Falls	115	115	--	--	--
Kimberly-Clark Corp.	Kimberly	150	--	--	150	--
Kimberly-Clark Corp.	Niagara	150	--	--	150	--
Mosinee Paper Mills Co.	Mosinee	200	--	200	--	--
Nekoosa-Edwards Paper Co.	Nekoosa	310	--	310	--	--
Nekoosa-Edwards Paper Co.	Port Edwards	215	215	--	--	--
Owens-Illinois	Tomahawk	615	--	--	--	615
Procter & Gamble Co.	Green Bay	[2]	[2]	--	[2]	--
Procter & Gamble Co.	Little Rapids	[2]	--	--	[2]	--
Scott Paper Co.	Marinette	50	50	--	--	--
Scott Paper Co.	Oconto Falls	110	110	--	--	--
St. Regis Paper Co.	Rhinelander	110	110	--	--	--
St. Regis Paper Co.	Cornell	50	--	--	50	--
Sterling Pulp & Paper Co.	Eau Claire	75	--	--	75	--
Superior Fiber Products Co.	Superior	180	--	--	180	--
Thilmany Pulp & Paper Co.	Kaukauna	360	--	360	--	--
Tomahawk Pulp Co., Inc.	Tomahawk	50	--	--	50	--
Wausau Paper Mills Co.	Brokaw	145	145	--	--	--
Wisconsin Wood Products, Inc.	Phillips	50	--	--	50	--
Total	27 plants	4,725	1,315	1,220	1,375	815
Michigan:						
Abitibi Corp.	Alpena	300	--	--	300	--
Celotex Corp.	L'Anse	270	--	--	270	--
Hoerner Waldorf Corp.	Ontonagon	250	--	--	--	250
Manistique Pulp & Paper Co.	Manistique	90	--	--	90	--
Mead Corp., The	Groos	100	--	--	100	--
Menasha Corp.	Otsego	225	--	--	--	225
Packaging Corp. of America	Filer City	600	--	200	--	400
Scott Paper Co.	Detroit	170	170	--	--	--
Scott Paper Co.	Menominee	20	--	--	20	--
Warren Co., S.D.	Muskegon	225	--	225	--	--
Total	10 plants	2,250	170	425	780	875
All States	46 plants	9,430	1,600	2,175	3,665	1,990

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[1] Lockwood's Directory of the Paper and Allied Industries-1969, and 1969 Directory of the Forest Products Industry.

[2] Capacity not available.

New Pulping Capacity Planned for 1971

An additional 750 tons per day of pulping capacity is planned in Michigan for start-up during the second half of 1971. The capacity would include a 600 ton-per-day kraft mill and a 150 ton-per-day groundwood mill. Plans have also been announced for a new $45 million pulpmill in the Minnesota-Ontario border area. If the mill opens on schedule in 1971, pulping capacity in and adjacent to the Lake States will be significantly increased, and many additional mill and woods jobs created.

Review of Pulpwood Production by States, 1968

Wisconsin provided 36 percent of the 1968 Lake States harvest, Michigan 33 percent, and Minnesota 31 percent.

The distribution of the pulpwood harvest is shown in two ways: first, the amount of

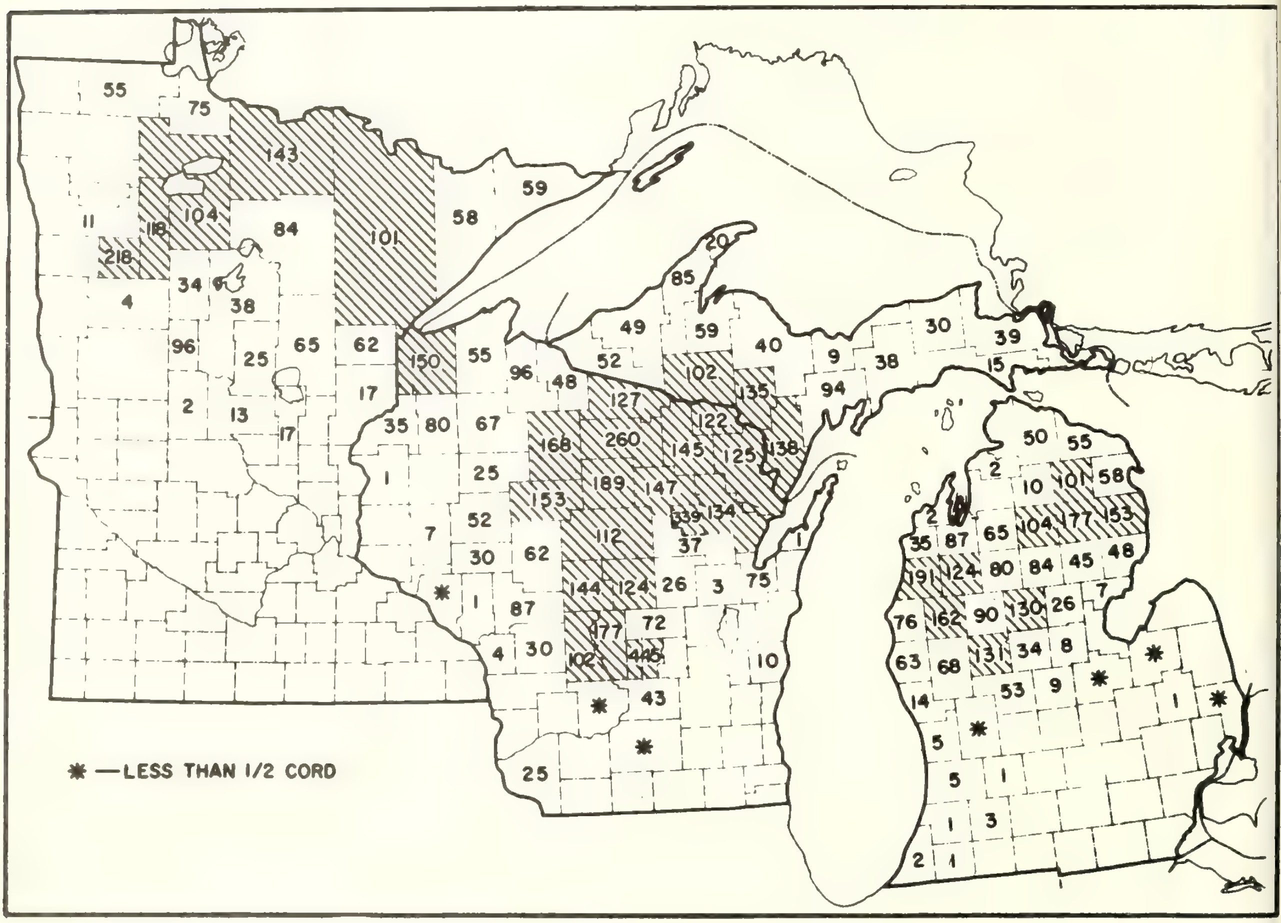

Figure 2. — Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1968. Crosshatching shows counties that supplied 100 or more cords of pulpwood per 1,000 acres of stocked commercial forest land.

pulpwood cut relative to commercial forest area, and second, the amount of pulpwood cut relative to the merchantable volume in major pulpwood species. The pulpwood cut per 1,000 acres of stocked commercial forest land was greatest in central and northeast Wisconsin, in three Upper Michigan counties bordering Wisconsin, in scattered counties in northern Lower Michigan, and in northern Minnesota (fig. 2). The harvest per 1,000 cords of merchantable volume in principal pulpwood species was greatest in central Wisconsin and least in southern Wisconsin (fig. 3).

Cutting intensified in central Wisconsin. — Although 1968 Wisconsin pulpwood output fell 119,000 cords from 1967, output in central Wisconsin increased 38,000 cords. Only 3 percent of the harvest was shipped out-of-State. Oneida, Price, and Douglas County loggers cut the largest pulpwood volume. In Marquette County, production jumped from 5,000 cords in 1967 to 30,000 cords in 1968.

Michigan Upper Peninsula output plunges 233,000 cords. — The effect of inventory adjustments in Wisconsin was most strongly felt in the Upper Peninsula of Michigan, where pulpwood shipments to Wisconsin were off

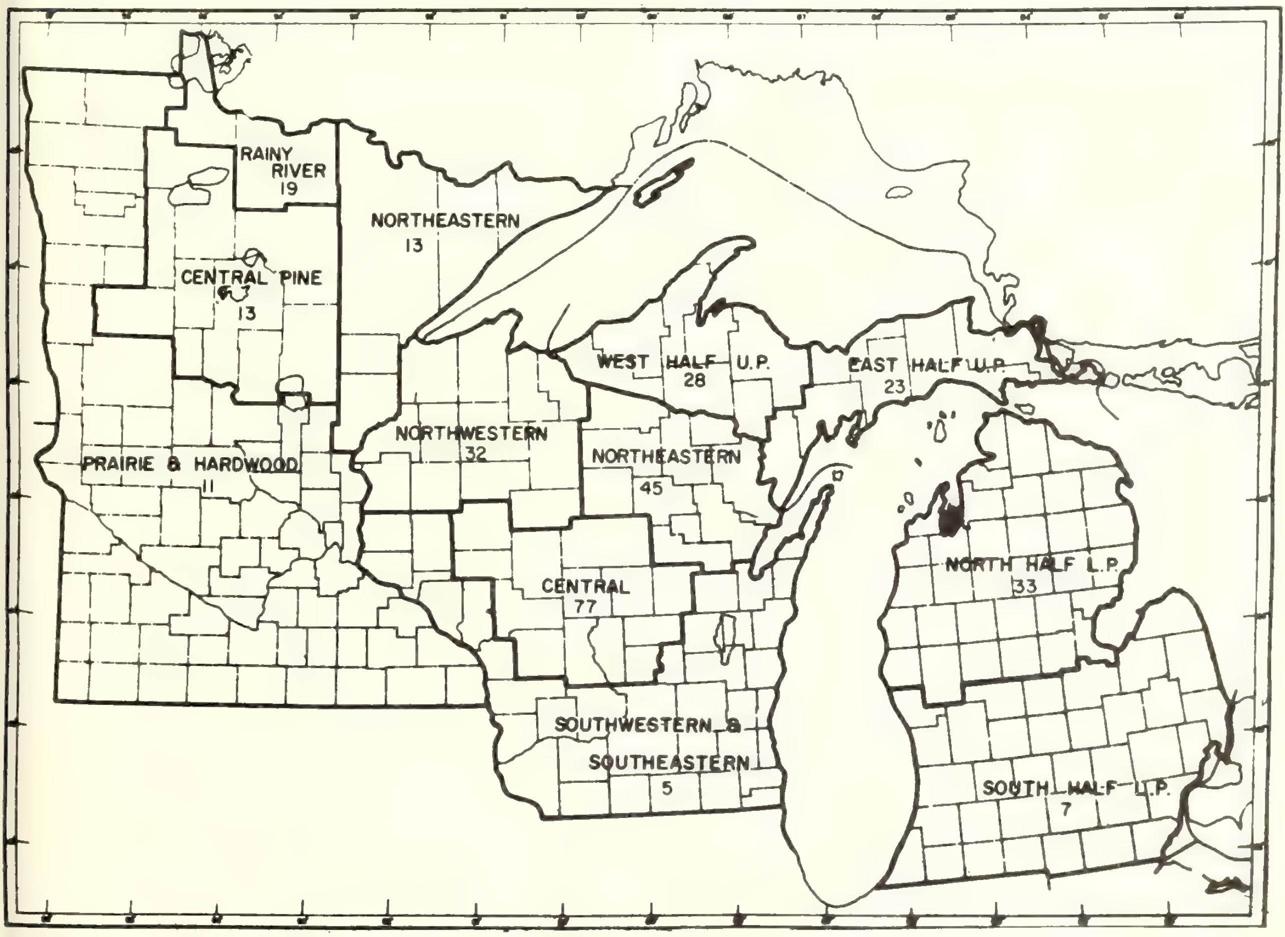

Figure 3. — Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species, by Forest Survey Unit, 1968. The heavy lines delineate the boundaries of the Forest Survey Units in each State.

205,000 cords compared with 1967. Four-fifths of the Upper Peninsula pulpwood cut was delivered to Wisconsin mills.

In the Lower Peninsula, which was unaffected by Wisconsin procurement decisions, pulpwood production rose 57,000 cords from the 1967 level. For the first time in at least 10 years, Lower Michigan pulpwood production was higher than Upper Peninsula production.

Minnesota harvest drops; Central Pine Unit most affected. — Minnesota pulpwood production declined 118,000 cords in 1968. In the Central Pine Unit, the roundwood harvest dwindled 93,000 cords. Wisconsin mills received 44 percent less pulpwood from Minnesota than in 1967, but shipments of local wood to Minnesota mills were up slightly. Leading pulpwood-producing counties were St. Louis, Koochiching, and Itasca.

CENTRAL STATES

Pulpwood production and receipts were the highest ever recorded in the Central States. The 333,000 cords produced in 1968 was nearly one-third higher than the output in 1967 (table 4). At least three factors accounted for the increase: first, new and rebuilt paper machines required more wood pulp, thus a larger percentage of pulping capacity was utilized than in 1967. Second, the product mix was changed to one using more pulpwood and less substitute materials. Finally, one company that had not received pulpwood for several years, reported wood receipts in 1968. Only 18,000 cords were exported from the region, of which 15,000 cords were hardwood residues.

Fifteen Central States pulpmills received a total of 78,000 more cords of pulpwood in 1968 than in 1967. Nine-tenths of the additional wood receipts originated in the Central States.

Pulpwood Output from Residues Climbs 82 Percent

Pulpwood production from plant residues in the Central States rose 55,000 cords and accounted for more than one-third of the total production in the region. About twice as many cords of hardwood plant residues from Illinois and Indiana were sold to pulpmills in 1968 than in 1967, and about two and one-half times as many cords from Missouri.

The region's roundwood harvest rose 25,000 cords in 1968. Three out of four roundwood cords were cut in Indiana and Illinois, as shown in the 5-year summary below:

In thousand cords

State	*1964*	*1965*	*1966*	*1967*	*1968*
Illinois	105	77	97	69	76
Indiana	85	82	94	69	87
Iowa	33	25	27	27	25
Missouri	23	20	19	21	23
	—	—	—	—	—
Total	246	204	237	186	211

Both soft and hard hardwoods shared in the roundwood harvest expansion.[3] Most of the gain in soft hardwood cutting was in Illinois, while most of the gain in hard hardwood cutting was shared equally by Indiana and Illinois.

Of the 111 pulpwood-producing counties, 39 were in Illinois, 39 in Indiana, 19 in Missouri, and 14 in Iowa (fig. 4). No county cut over 11,500 cords of pulpwood. Top-producing counties in each State were Lawrence and Gibson in Indiana, Wabash and Union in Illinois, Saline and Howard in Missouri, and Lee and Dubuque in Iowa.

Nearly 2 Out of 5 Cords Received Are Residues

Pulpwood shipments to Central States mills rose 27 percent in 1968. Of this increase, 70 percent was residues from wood-using plants. Illinois pulpmills bought 65 percent of the residues, most of which was received as chips. The increment in volume of residues purchased by Central States pulpmills in 1968 over 1967 equaled the entire volume of residues purchased in 1966 (table 5). Since 1964, procurement of residue by regional mills has risen more than 100,000 cords.

Although regional roundwood receipts climbed in 1968, they have stayed between 200,000 and 250,000 cords for at least 6 years. Meanwhile, sawmills, veneer mills, cooperage mills, and other wood-using plants have found the pulpmills to be a rapidly expanding market for their slabs, edgings, veneer cores, sawdust, and wood flour.

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[3] *Soft hardwoods include species such as elm, basswood, soft maple, yellow-poplar, and cottonwood. Hard hardwoods include oak, hard maple, beech, and hickory.*

Table 4. — *Central States pulpwood production and receipts, by State, 1968*
(In standard cords, unpeeled)[1]

Species group and destination	Production by States [2]					Imports			Total receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake States	Other U. S.	Total imports	
Softwoods									
Illinois	504	--	--	--	504	--	--	--	504
Ind., Iowa, Mo.[3]	--	--	--	--	--	--	--	--	--
Exported [4]	--	53	--	--	53	--	--	--	--
Total	504	53	--	--	557	--	--	--	504
Soft hardwoods									
Illinois	35,761	1,302	--	544	37,607	2,222	1,111	3,333	40,940
Ind., Iowa, Mo.	8,989	38,178	12,035	19,409	78,611	1,777	3,956	5,733	84,344
Exported [4]	--	82	--	364	446	--	--	--	--
Total	44,750	39,562	12,035	20,317	116,664	3,999	5,067	9,066	125,284
Hard hardwoods									
Illinois	21,904	3,927	--	1,050	26,881	--	--	--	26,881
Ind., Iowa, Mo.	8,532	41,424	12,842	2,155	64,953	3,000	3,936	6,936	71,889
Exported [4]	--	1,947	--	--	1,947	--	--	--	--
Total	30,436	47,298	12,842	3,205	93,781	3,000	3,936	6,936	98,770
Total roundwood									
Illinois	58,169	5,229	--	1,594	64,992	2,222	1,111	3,333	68,325
Ind., Iowa, Mo.	17,521	79,602	24,877	21,564	143,564	4,777	7,892	12,669	156,233
Exported [4]	--	2,082	--	364	2,446	--	--	--	--
Total	75,690	86,913	24,877	23,522	211,002	6,999	9,003	16,002	224,558
Residues, softwood									
Illinois	231	--	2,833	--	3,064	5,539	2,806	8,345	11,409
Ind., Iowa, Mo.	--	--	--	--	--	--	5,310	5,310	5,310
Exported [4]	--	--	--	--	--	--	--	--	--
Total	231	--	2,833	--	3,064	5,539	8,116	13,655	16,719
Residues, hardwood									
Illinois	26,965	--	--	38,765	65,730	2,925	11,562	14,487	80,217
Ind., Iowa, Mo.	12,040	16,782	9,012	249	38,083	5,454	917	6,371	44,454
Exported [4]	--	13,962	1,140	--	15,102	--	--	--	--
Total	39,005	30,744	10,152	39,014	118,915	8,379	12,479	20,858	124,671
All wood material									
Illinois	85,365	5,229	2,833	40,359	133,786	10,686	15,479	26,165	159,951
Ind., Iowa, Mo.	29,561	96,384	33,889	21,813	181,647	10,231	14,119	24,350	205,997
Exported [4]	--	16,044	1,140	364	17,548	--	--	--	--
Total	114,926	117,657	37,862	62,536	332,981	20,917	29,598	50,515	365,948

---

[1] Factors used in converting to standard green cords (128 cu. ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard-hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

[2] Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

[3] Combined to prevent disclosure of individual mill receipts.

[4] Pulpwood shipped to mills outside the region.

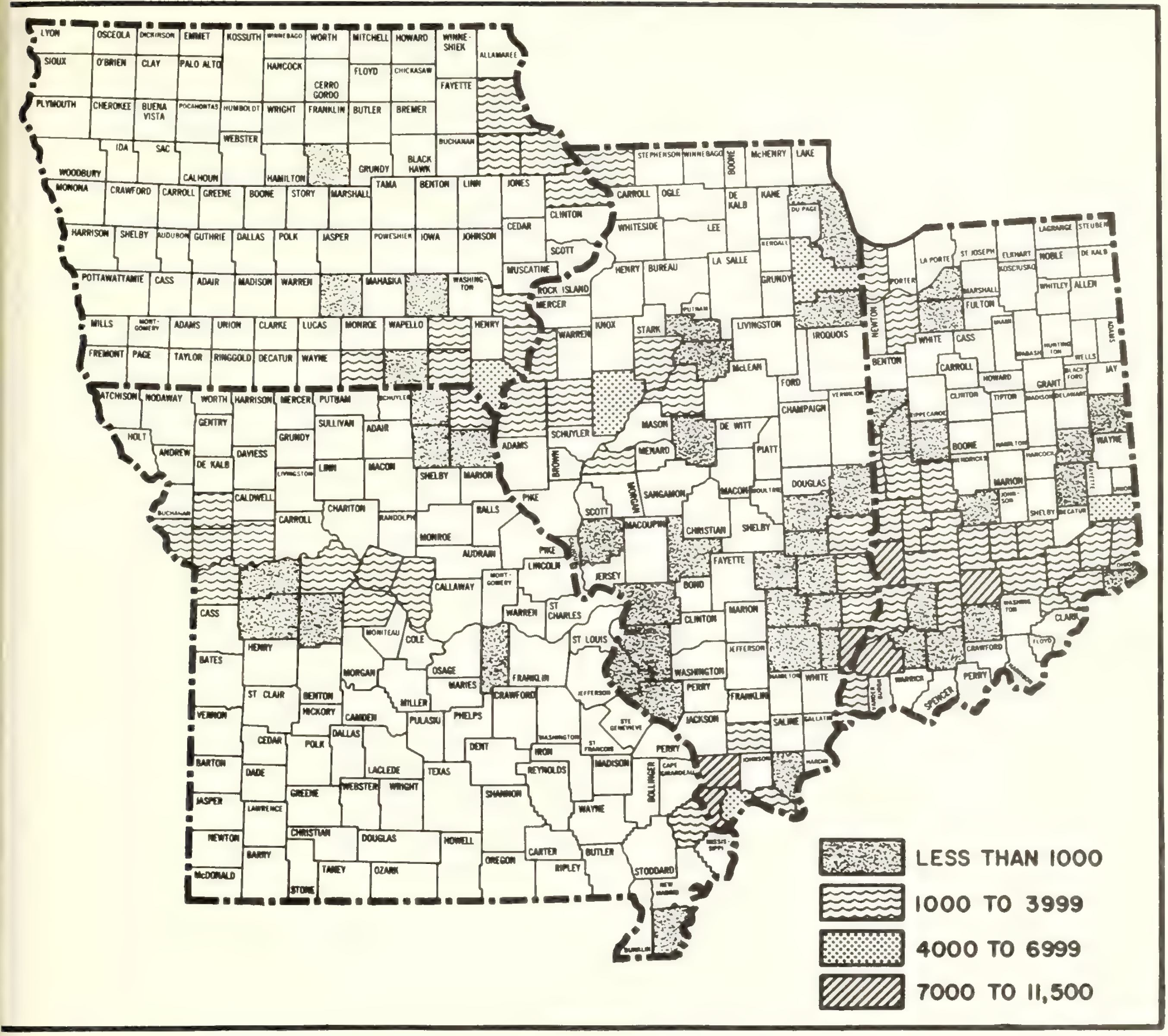


Figure 4.— Harvest of pulpwood bolts by counties, in standard cords, 1968.

Active Pulpmill Capacity Stable; New Mill in Kentucky

Fifteen active regional plants had a total of 1,560 tons per day of mechanical and semichemical pulping capacity in 1968 (table 6). No significant increases in capacity have been announced. However, a 200 ton-per-day kraft pulpmill began operation in May, 1969 in Kentucky adjacent to Indiana. Pulpwood suppliers in southern Indiana and Illinois may generate additional business from this new mill.

Table 5. — *Trends in receipts of roundwood and residues as pulpwood, Central States, 1964-1968*

Type of material and area	1964	1965	1966	1967	1968
Roundwood					
Illinois	82	68	84	63	68
Indiana, Iowa, Missouri	163	143	163	138	156
Total	245	211	247	201	224
Residue					
Illinois	25	22	25	50	92
Indiana, Iowa, Missouri	14	24	29	37	50
Total	39	46	54	87	142
All material	284	257	301	288	366

Table 6. — *Active woodpulp mills in the Central States by location, type of pulp produced, and capacity, 1968*

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Illinois:						
Philip Carey Corp................	Wilmington..........	30	--	--	30	--
Celotex Corp....................	Peoria..............	190	--	--	190	--
Alton Box Board Co..............	Alton...............	300	--	--	--	300
Bird & Son, Inc..................	Chicago.............	40	--	--	40	--
Certain-Teed Products Corp.......	East St. Louis.......	100	--	--	100	--
Flintkote Co., The..............	Mt. Carmel..........	40	--	--	40	--
Johns-Manville Products Corp.....	Waukegan............	65	--	--	65	--
GAF Corp........................	Joliet..............	100	--	--	100	--
Total.........................	8 plants............	865	--	--	565	300
Indiana:						
Container Corp. of America.......	Carthage............	120	--	--	--	120
Weston Paper & Manufacturing Co..	Terre Haute.........	250	--	--	--	250
Total.........................	2 plants............	370	--	--	--	370
Iowa:						
Celotex Corp....................	Dubuque.............	90	--	--	--	90
Consolidated Packaging Corp......	Fort Madison.........	135	--	--	--	135
United States Gypsum Co..........	Fort Dodge..........	[2]	--	--	--	--
Total.........................	3 plants............	225	--	--	--	225
Missouri:						
Huebert Fiberboard, Inc..........	Booneville..........	60	--	--	60	--
GAF Corp........................	Kansas City.........	40	--	--	40	--
Total.........................	2 plants............	100	--	--	100	--
All States	15 plants	1,560	--	--	665	895

[1] Lockwood's Directory of the Paper and Allied Industries-1969, and 1969 Directory of the Forest Products Industry.

[2] Capacity not available.

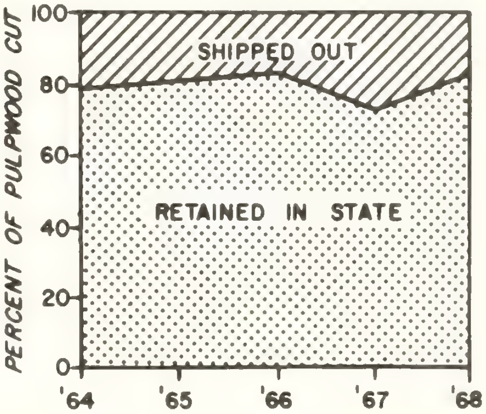
APPENDIX

Table 7.—*Lake States pulpwood production, by State of origin and destination, 1964-1968*

MINNESOTA

Year	Total cut	Destination of pulpwood			
		Minn.	**Wis.**	Mich.	Other
		(Thousand standard cords)			
1964	1,062	856	193	--	13
1965	1,018	842	159	--	17
1966	1,174	970	193	*	11
1967	1,205	884	299	*	22
1968	1,087	900	166	*	21
5-year average	1,109	890	202	*	17

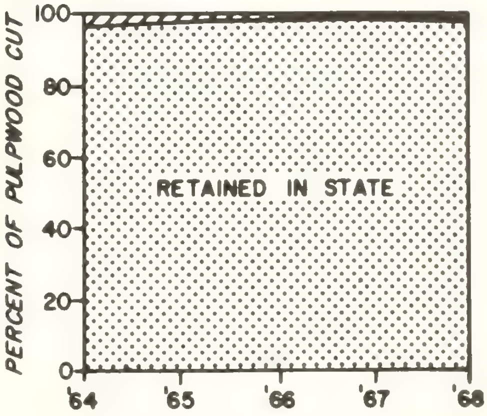
*Less than 500 cords.



WISCONSIN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1964	1,244	19	1,207	2	16
1965	1,253	8	1,225	1	19
1966	1,536	13	1,501	3	19
1967	1,416	15	1,387	*	14
1968	1,297	22	1,259	4	12
5-year average	1,349	15	1,316	2	16

*Less than 500 cords.



MICHIGAN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1964	1,321	--	588	730	3
1965	1,365	--	608	750	7
1966	1,570	1	666	901	2
1967	1,344	--	660	684	*
1968	1,168	--	455	702	11
5-year average	1,354	*	595	754	5

*Less than 500 cords.

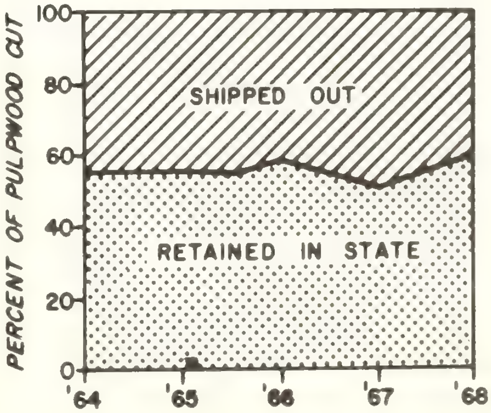


Table 8.—*Lake States pulpwood production, by Forest Survey Unit and destination by State, 1968*

(Thousand standard cords, roughwood basis)

MINNESOTA

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	421	319	98	*	4
Central Pine	363	308	54	--	1
Rainy River	240	216	8	--	16
Hardwood & Prairie	63	57	6	--	--
Total	1,087	900	166	*	21

WISCONSIN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	603	--	599	4	--
Northwestern	410	9	401	--	--
Central	245	3	242	--	*
Southeastern & Southwestern	39	10	17	--	12
Total	1,297	22	1,259	4	12

MICHIGAN

District	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
E. 1/2 Up. Pen.	213	--	158	49	6
W. 1/2 Up. Pen.	357	--	297	60	--
N. 1/2 Low. Pen.	549	--	--	549	--
S. 1/2 Low. Pen.	49	--	--	44	5
Total	1,168	--	455	702	11

*Less than 500 cords.

Table 9. — *Lake States pulpwood production by species, State, and Forest Survey Unit, 1964-1968*

(Thousand standard cords, roughwood basis)

State and district	ASPEN					BALSAM FIR				
	Annual production					Annual production				
	1964	1965	1966	1967	1968	1964	1965	1966	1967	1968
MINNESOTA										
Northeastern	176	177	205	205	203	26	22	20	26	12
Central Pine	172	186	272	265	218	32	23	35	30	18
Rainy River	91	96	123	108	131	31	28	25	20	13
Prairie & Hardwood	12	9	12	13	31	*	*	--	--	*
Total	451	468	612	591	583	89	73	80	76	43
WISCONSIN										
Northeastern	332	341	449	430	369	27	25	28	26	25
Northwestern	208	220	298	273	202	29	24	26	21	22
Central	61	45	61	35	55	1	1	1	*	4
Southeastern & Southwestern	2	2	2	1	3	*	--	--	*	--
Total	603	608	810	739	629	57	50	55	47	51
MICHIGAN										
E. 1/2 Up. Pen.	112	142	156	144	95	47	41	48	50	39
W. 1/2 Up. Pen.	206	207	222	237	167	33	30	37	38	22
N. 1/2 Low. Pen.	332	341	388	258	274	4	2	3	3	1
S. 1/2 Low. Pen.	25	14	10	7	5	--	--	--	--	--
Total	675	704	776	646	541	84	73	88	91	62
LAKE STATES	1,729	1,780	2,198	1,976	1,753	230	196	223	214	156

*Less than 500 cords.

(Continued on next page)

(Table 9 continued)

(Thousand standard cords, roughwood basis)

MINNESOTA

State and district	BIRCH					HEMLOCK				
	Annual production					Annual production				
	1964	1965	1966	1967	1968	1964	1965	1966	1967	1968
Northeastern	--	--	--	1	*	--	--	--	--	--
Central Pine	*	*	1	2	1	--	--	--	--	-
Rainy River	--	--	--	--	--	--	--	--	--	--
Prairie & Hardwood	--	--	--	--	--	--	--	--	--	--
Total	*	*	1	3	1	--	--	--	--	--
WISCONSIN										
Northeastern	8	5	9	28	18	27	37	48	27	22
Northwestern	28	17	26	46	35	22	21	18	13	18
Central	5	2	4	10	3	3	2	3	2	4
Southeastern & Southwestern	*	*	--	*	*	--	--	--	--	*
Total	41	24	39	84	56	52	60	69	42	44
MICHIGAN										
E. 1/2 Up. Pen.	14	5	3	3	2	10	9	21	16	9
W. 1/2 Up. Pen.	6	1	2	2	*	49	55	78	44	36
N. 1/2 Low. Pen.	18	26	8	6	11	--	--	--	--	--
S. 1/2 Low. Pen.	--	--	--	--	--	--	--	--	--	--
Total	38	32	13	11	13	59	64	99	60	45
LAKE STATES	79	56	53	55	70	111	124	168	102	89

*Less than 500 cords.

(Continued on next page)

(Table 9 continued)

(Thousand standard cords, roughwood basis)

MINNESOTA

State and district	JACK PINE[1/] Annual production 1964	1965	1966	1967	1968	SPRUCE Annual production 1964	1965	1966	1967	1968
Northeastern	129	101	138	108	121	118	106	78	93	66
Central Pine	49	56	85	69	62	50	38	31	45	31
Rainy River	17	12	15	11	12	88	92	61	79	60
Prairie & Hardwood	9	12	18	14	8	1	2	2	1	*
Total	204	181	256	202	203	257	238	172	218	157
WISCONSIN										
Northeastern	48	57	58	45	46	13	10	14	10	7
Northwestern	51	76	92	61	57	6	5	4	3	3
Central	68	72	64	67	94	*	*	*	*	1
Southeastern & Southwestern	1	1	1	1	2	*	--	--	--	--
Total	168	206	215	174	199	19	15	18	13	11
MICHIGAN										
E. 1/2 Up. Pen.	51	66	63	40	39	33	28	31	33	23
W. 1/2 Up. Pen.	40	47	47	36	33	35	36	42	40	16
N. 1/2 Low. Pen.	106	110	138	115	131	3	1	1	2	*
S. 1/2 Low. Pen.	1	1	2	2	2	--	--	--	--	--
Total	198	224	250	193	205	71	65	74	75	39
LAKE STATES	570	611	721	569	607	347	318	264	306	207

*Less than 500 cords.

[1/] Includes small quantity of red and white pine.

(Continued on next page)

(Table 9 continued)

(Thousand standard cords, roughwood basis)

MINNESOTA

State and district	TAMARACK					MISC. HARDWOODS				
	Annual production					Annual production				
	1964	1965	1966	1967	1968	1964	1965	1966	1967	1968
Northeastern	7	5	1	6	4	3	4	4	9	7
Central Pine	5	6	6	27	16	29	24	13	6	5
Rainy River	--	--	*	4	4	9	10	13	23	9
Prairie & Hardwood	*	1	*	3	1	3	3	1	1	2
Total	12	12	7	40	25	44	41	31	39	23
WISCONSIN										
Northeastern	1	1	1	2	3	44	56	80	64	60
Northwestern	3	3	2	1	2	93	56	70	62	50
Central	*	--	*	--	*	75	77	84	71	68
Southeastern & Southwestern	--	*	--	--	--	12	9	8	6	7
Total	4	4	3	3	5	224	198	242	203	185
MICHIGAN										
E. 1/2 Up. Pen.	2	2	1	1	1	7	8	16	6	3
W. 1/2 Up. Pen.	1	1	*	*	1	60	63	70	79	48
N. 1/2 Low. Pen.	--	*	--	--	--	76	75	103	112	116
S. 1/2 Low. Pen.	--	--	--	--	--	3	3	5	2	4
Total	3	3	1	1	2	146	149	194	199	171
LAKE STATES	19	19	11	44	32	414	388	467	484	379

*Less than 500 cords.

(Continued on next page)

(Table 9 continued)

(Thousand standard cords, roughwood basis)

MINNESOTA

State and district	RESIDUES & CHIPS1/ Annual production					ALL SPECIES2/ Annual production				
	1964	1965	1966	1967	1968	1964	1965	1966	1967	1968
Northeastern	--	1	3	11	8	459	416	449	459	421
Central Pine	2	2	6	9	12	339	335	449	453	363
Rainy River	--	--	--	4	11	236	238	237	249	240
Prairie & Hardwood	3	2	6	12	21	28	29	39	44	63
Total	5	5	15	36	52	1,062	1,018	1,174	1,205	1,087
WISCONSIN										
Northeastern	43	51	49	41	53	543	583	736	673	603
Northwestern	15	8	7	22	21	455	430	543	502	410
Central	12	6	5	22	16	225	205	222	207	245
Southeastern & Southwestern	6	23	24	26	27	21	35	35	34	39
Total	76	88	85	111	117	1,244	1,253	1,536	1,416	1,297
MICHIGAN										
E. 1/2 Up. Pen.	6	5	11	2	2	282	306	350	295	213
W. 1/2 Up. Pen.	38	26	23	32	34	468	466	521	508	357
N. 1/2 Low. Pen.	--	--	3	11	16	539	555	644	507	549
S. 1/2 Low. Pen.	3	20	38	23	38	32	38	55	34	49
Total	47	51	75	68	90	1,321	1,365	1,570	1,344	1,168
LAKE STATES	128	144	175	215	259	3,627	3,636	4,280	3,965	3,552

1/ Not reported by district. Prorated on basis of most recent lumber output figures and location at shipping points.

2/ Including residues and chips.

Table 10. — *Lake States pulpwood production by county and species, 1968*

(Thousand standard cords, roughwood basis)

WISCONSIN

District & county[1/]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residues & chips [2/]
NORTHEASTERN:										
Florence	30	24	1	*	2	1	1	--	1	
Forest	73	47	5	2	6	2	2	*	9	
Langlade	50	35	1	2	1	1	*	*	10	
Lincoln	61	38	3	2	2	4	1	1	10	
Marinette	67	56	2	1	*	2	1	1	4	
Menominee	39	32	*	*	5	1	--	*	1	
Oconto	43	36	*	1	1	3	*	*	2	
Oneida	125	68	9	5	2	23	2	1	15	
Shawano	11	5	1	*	2	*	*	*	3	
Vilas	51	28	3	5	1	9	*	*	5	
Total	603	369	25	18	22	46	7	3	60	53
NORTHWESTERN:										
Ashland	47	27	7	2	3	2	1	*	5	
Bayfield	40	21	1	5	1	11	*	*	1	
Burnett	10	2	--	--	--	8	*	*	*	
Douglas	76	56	*	1	--	19	*	*	*	
Iron	18	6	3	2	3	*	1	*	3	
Polk	*	--	*	--	--	*	--	*	--	
Price	81	34	6	13	5	2	1	1	19	
Rusk	8	6	*	*	*	--	*	*	1	
Sawyer	38	13	4	9	2	3	*	*	7	
Taylor	46	23	1	3	4	1	*	1	13	
Washburn	26	14	*	*	*	11	*	*	1	
Total	410	202	22	35	18	57	3	2	50	21
CENTRAL:										
Adams	35	1	--	--	--	18	*	--	16	
Chippewa	11	10	*	*	*	*	--	*	1	
Clark	16	6	--	1	*	3	--	*	6	
Eau Claire	4	1	--	--	--	3	--	*	--	
Jackson	26	1	--	--	--	23	--	--	2	
Juneau	23	4	--	*	--	15	--	*	4	
Marathon	33	10	1	2	2	2	*	--	16	
Marquette	30	12	3	--	2	9	--	--	4	
Monroe	6	*	--	--	--	6	--	--	*	
Portage	15	3	*	*	*	5	1	--	6	
Waupaca	3	2	*	*	*	*	*	--	1	
Waushara	7	1	--	--	--	3	--	--	3	
Wood	20	4	*	*	*	7	--	--	9	
Total	245	55	4	3	4	94	1	*	68	16

(Continued on next page)

(Table 10 continued)

(Thousand standard cords, roughwood basis)

WISCONSIN (continued)

District & county1/	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues & chips 2/
SOUTHWESTERN:										
Dunn	1	1	--	--	--	*	--	--	--	
Grant	4	--	--	--	--	--	--	--	4	
La Crosse	1	--	--	--	--	1	--	--	--	
Sauk	*	--	--	--	--	*	--	--	--	
Trempealeau	*	*	--	--	--	*	--	--	--	
Total	22	1	--	--	--	1	--	--	4	16
SOUTHEASTERN:										
Brown	2	2	--	*	*	*	--	--	--	
Columbia	3	*	--	--	--	*	--	--	3	
Dane	*	*	--	--	--	--	--	--	--	
Door	*	*	--	--	--	--	--	--	*	
Outagamie	*	*	--	--	--	--	--	--	*	
Sheboygan	1	--	--	--	--	1	--	--	--	
Total	17	2	--	*	*	1	--	--	3	11
State total	1,297	629	51	56	44	199	11	5	185	117

1/ Includes only those counties that supplied pulpwood in 1968.

2/ County figures are not available.

* Less than 500 cords.

(Table 10 continued)

(Thousand standard cords, roughwood basis)

MICHIGAN

District & county1/	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues & chips 2/
E. 1/2 UP. PEN.										
Alger	5	1	1	--	*	3	*	--	*	
Chippewa	30	9	5	*	2	8	5	1	--	
Delta	58	23	13	1	3	11	5	*	2	
Luce	15	2	1	--	2	8	2	*	--	
Mackinac	9	2	3	--	*	2	2	*	--	
Menominee	70	52	10	*	1	1	5	*	1	
Schoolcraft	24	6	6	1	1	6	4	*	*	
Total	213	95	39	2	9	39	23	1	3	2
W. 1/2 UP. PEN.										
Baraga	31	16	1	--	4	2	1	*	7	
Dickinson	60	44	7	--	2	3	4	*	*	
Gogebic	33	17	2	*	7	1	*	*	6	
Houghton	47	16	2	*	16	2	2	*	9	
Iron	69	46	4	*	3	1	2	1	12	
Keweenaw	4	*	2	--	--	--	2	*	--	
Marquette	44	11	4	*	1	24	4	*	*	
Ontonagon	35	17	*	*	3	*	1	*	14	
Total	357	167	22	*	36	33	16	1	48	34
N. 1/2 LOW. PEN.										
Alcona	48	33	*	3	--	3	*	--	9	
Alpena	12	7	*	2	--	*	*	--	3	
Arenac	1	1	--	--	--	--	--	--	--	
Benzie	4	3	--	--	--	--	--	--	1	
Charlevoix	*	*	--	--	--	--	--	--	--	
Cheboygan	16	9	*	2	--	2	*	--	3	
Clare	29	24	--	--	--	3	--	--	2	
Crawford	31	4	--	--	--	27	--	--	*	
Gladwin	5	2	--	--	--	1	--	--	2	
Grand Traverse	14	9	--	--	--	3	--	--	2	
Iosco	12	4	--	--	--	8	--	--	*	
Isabella	3	3	--	--	--	--	--	--	*	
Kalkaska	17	10	--	--	--	6	--	--	1	
Lake	47	12	--	--	--	16	--	--	19	
Leelanau	*	--	--	--	--	*	--	--	*	
Manistee	41	14	--	--	--	1	--	--	26	
Mason	12	4	--	--	--	1	--	--	7	
Mecosta	19	16	--	--	--	*	--	--	3	
Midland	1	1	--	--	--	--	--	--	*	
Missaukee	18	13	--	--	--	2	--	--	3	
Montmorency	29	18	*	1	--	4	*	--	6	
Newaygo	20	10	--	--	--	3	--	--	7	
Oceana	9	3	--	--	--	2	--	--	4	
Ogemaw	11	5	--	*	--	5	--	--	1	
Osceola	15	11	--	--	--	*	--	--	4	
Oscoda	53	25	*	1	--	23	*	--	4	
Otsego	2	--	--	--	--	2	--	--	--	
Presque Isle	15	7	1	2	--	2	*	--	3	
Roscommon	22	10	--	--	--	9	--	--	3	
Wexford	27	16	--	--	--	8	--	--	3	
Total	549	274	1	11	--	131	*	--	116	16

(Continued on next page)

(Table 10 continued)

(Thousand standard cords, roughwood basis)

MICHIGAN (continued)

District & county[1]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residues & chips [2]
S. 1/2 LOW. PEN.										
Allegan	1	*	--	--	--	--	--	--	1	
Barry	*	*	--	--	--	--	--	--	*	
Berrien	*	--	--	--	--	--	--	--	*	
Cass	*	*	--	--	--	--	--	--	*	
Gratiot	1	1	--	--	--	--	--	--	--	
Kalamazoo	*	*	--	--	--	*	--	--	*	
Kent	*	*	--	--	--	--	--	--	*	
Lapeer	*	*	--	--	--	--	--	--	--	
Montcalm	7	4	--	--	--	1	--	--	2	
Muskegon	2	*	--	--	--	1	--	--	1	
Ottawa	*	*	--	--	--	*	--	--	*	
Saginaw	*	--	--	--	--	*	--	--	--	
St. Clair	*	*	--	--	--	--	--	--	--	
Tuscola	*	*	--	--	--	--	--	--	--	
Van Buren	*	--	--	--	--	--	--	--	*	
Total	49	5	--	--	--	2	--	--	4	38
State total	1,168	541	62	13	45	205	39	2	171	90

[1] Includes only those counties that supplied pulpwood in 1968.
[2] County figures are not available.
* Less than 500 cords.

(Table 10 continued)

(Thousand standard cords, roughwood basis)

MINNESOTA

District & county1/	All species	Aspen	Balsam	Birch	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues & chips 2/
NORTHEASTERN:									
Carlton	19	17	1	*	1	*	*	--	
Cook	39	*	1	--	6	32	--	--	
Lake	58	16	1	--	26	15	*	--	
Pine	7	4	*	--	1	--	--	2	
St. Louis	290	166	9	*	87	19	4	5	
Total	421	203	12	*	121	66	4	7	8
CENTRAL PINE:									
Aitkin	45	35	2	--	1	3	4	*	
Becker	1	1	*	--	*	*	*	--	
Beltrami	85	59	6	1	8	9	2	*	
Cass	35	16	1	*	9	1	4	4	
Clearwater	39	29	1	--	4	2	2	1	
Crow Wing	10	3	*	--	7	*	--	--	
Hubbard	14	4	*	--	9	*	1	--	
Itasca	111	67	8	--	17	16	3	*	
Wadena	11	4	--	--	7	--	--	--	
Total	363	218	18	1	62	31	16	5	12
RAINY RIVER:									
Koochiching	199	128	13	--	8	39	2	9	
Lake of the Woods	30	3	*	--	4	21	2	--	
Total	240	131	13	--	12	60	4	9	11
HARDWOOD:									
Mille Lacs	2	1	--	--	--	--	*	1	
Morrison	2	2	*	--	--	*	--	--	
Todd	*	*	--	--	--	*	--	--	
Total	25	3	*	--	--	*	*	1	21
PRAIRIE:									
Mahnomen	26	25	--	--	--	--	*	1	
Polk	1	*	--	--	--	--	1	--	
Roseau	11	3	--	--	8	--	*	--	
Total	38	28	--	--	8	--	1	1	--
State total	1,087	583	43	1	203	157	25	23	52

1/ Includes only those counties that supplied pulpwood in 1968.
2/ County figures are not available.
* Less than 500 cords.

ABOUT THE FOREST SERVICE . . .

As our Nation grows, people expect and need more from their forests — more wood; more water, fish, and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:

- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the Country's forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.

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the
Growing Timber Resource of Michigan
1966

Clarence D. Chase
Ray E. Pfeifer
John S. Spencer, Jr.

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

FOREWORD

This report presents Michigan's timber resource in 1966 as found by the third Forest Survey of Michigan. It provides forest area, timber inventory, growth, mortality, removals, and forest industry statistics. It compares some of the findings with those of two previous surveys, 1935 and 1955.

The third Michigan Forest Survey was part of the continuing program authorized by Congress in the McSweeney-McNary Forest Research Act of 1928 to maintain a current inventory of the Nation's timber supply. The survey was organized and conducted by the North Central Forest Experiment Station, although all work was done under broad guidelines of the Forest Survey Steering Committee, a group composed of many public and private foresters within the State. A cooperative survey, the Michigan Department of Natural Resources provided substantial financial aid to obtain more accurate and localized statistics, provided timber resource data for the State Forests, and assisted in a canvass of timber use in the State. Through the Upper Peninsula Committee on Area Progress, funds were obtained from the Area Redevelopment Administration (later the Economic Development Administration) to purchase recent aerial photographs of most of the Upper Peninsula. The Eastern Region of the U.S.D.A. Forest service provided timber resource data for the four National Forests in Michigan. The State Office of the Agricultural Stabilization and Conservation Service provided aerial photographs for the Lower Peninsula. Appreciation is expressed to all those who participated in this forest resource investigation.

North Central Forest Experiment Station
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THE AUTHORS are, respectively, Principal Resource Analyst (retired), North Central Forest Experiment Station; Staff Forester, Michigan Department of Natural Resources; and Resource Analyst, North Central Forest Experiment Station. The Station is maintained in cooperation with the University of Minnesota.

HIGHLIGHTS

Timber Volume

- Growing-stock volume on commercial forest land in 1966 was 15.0 billion cubic feet, a 40-percent increase from the 10.7 billion cubic feet in 1955.
- The volume in sawtimber trees was 33.9 billion board feet in 1966, compared with 23.8 billion board feet in 1955.
- The average volume per acre of growing stock jumped from 7 cords in 1955 to 10 cords in 1966.
- Sawtimber stands averaged 1,240 board feet per acre in 1955 and rose to 1,790 board feet per acre in 1966.
- Hardwoods account for almost three-fourths of the growing-stock volume. Aspen and hard maple are the chief species.
- Two-thirds of the timber volume is in private ownership.
- In addition to the volume in sound, live (growing-stock) trees, there were 1,173 million cubic feet of sound wood in rough and rotten trees and 57 million cubic feet of sound wood in salvable dead trees.

Stand Conditions

- Net annual growth on growing stock was 580 million cubic feet in 1965, 18 percent greater than in 1954.
- The net annual growth rate averaged 3.9 percent of the inventory of growing stock.
- Mortality of growing stock was 244 million cubic feet in 1965, largely affecting quaking aspen, balsam fir, elm, and bigtooth aspen.
- Half of the State's timber stands are less than 40 years old.
- Although 51 percent of the commercial area is well stocked with growing-stock trees, "desirable" tree stocking is sparse.
- Fifteen percent of the commercial forest is more open than tree-covered (less than 50 percent stocked).

Forest Area

- Commercial forests, which represent 52 percent of Michigan's land area, included 18.9 million acres in 1966, a slight decline from the 19.1 million acres in 1955.
- Poletimber stands constitute 43 percent of the State's commercial forest, more than any other stand-size class.
- The maple-beech-birch type (5.2 million acres) and the aspen-birch type (4.7 million acres) constituted the largest share of the commercial forest.

Timber Use

- Growing-stock removals in 1965 amounted to 206 million cubic feet, 16 percent more than in 1954.
- Michigan's allowable annual cut from growing stock between 1966 and 1975 is estimated to be 380 million cubic feet.
- Sawtimber removals in 1965 were 823 million board feet, less than the allowable annual cut of 910 million board feet.
- Pulpwood made up more than half the volume of growing-stock removals.
- Between 1954 and 1965 the number of primary wood-using plants in Michigan decreased from 2,100 to 437, yet roundwood consumption rose about 12 million cubic feet.
- Removals of growing stock in 1996 are projected to be double those in 1966. Growth on growing stock is projected to remain above timber removals during this period, resulting in a larger inventory in 1996 than in 1966.
- Projected sawtimber removals, growth, and inventory are similar to those of growing stock.

the Growing Timber Resource of Michigan 1966

Clarence D. Chase, Ray E. Pfeifer, and John S. Spencer, Jr.

THE FOREST

Timber volume in Michigan has increased
nce the first survey in 1935 despite a slight de-
ine in commercial forest area. About half of
ichigan's land area is forested, boasting a total
15 billion cubic feet of sound, live (growing-
ock) trees. This increase in volume has come
bout largely because growth has remained great-
than timber removals. Many of the seedling-
pling stands that dominated the 1955 forest
ave grown into poletimber stands—the most ex-
nsive stand-size class in 1966.

What forces molded Michigan's forest into
eir present shape? There were an estimated
.5 million acres of forest land in what is now
e State of Michigan when the earliest trappers
d explorers arrived. This original forest con-
ined about 10 million acres of prime pine and
million acres of high-quality northern hard-
oods. The heavy cutting that followed the shift
logging activity from the eastern United States
the Lake States leveled much of the forest,
d repeated fires destroyed much of what was
left. Timber from this early logging provided a substantial amount of the products needed for building a rapidly expanding Midwest. Some of the cutover forest was cleared by settlers. By 1935 Michigan's once-magnificent forest had been reduced to about 19 million acres, nearly half of which was nonstocked or in the postfire aspen-brush type.

The pendulum was set in motion toward an improving forest situation in the 1920's when an effective fire control program was initiated. In the absence of fire, natural regeneration began to reforest many former nonstocked areas. A tree-planting program that began in earnest in the 1920's along with the public's growing acceptance of the concept of forest management, also helped to bring about the remarkable recovery of Michigan's forest over the last four decades (fig. 1).

Today the condition of the forest is still far from ideal, but a measure of the improvement that has occurred can be seen by comparing survey data for 1955 and 1966.

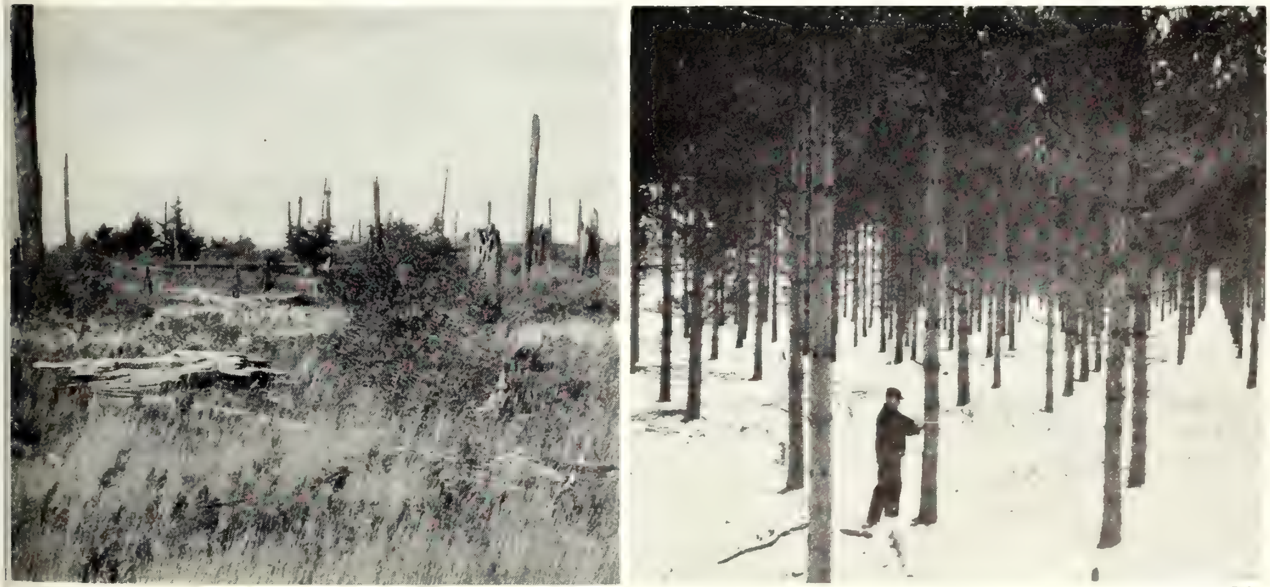
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Figure 1.—The bleak scene at the left typified much of Michigan's forest land in the early 1900's. Happily, most of those denuded acres are now growing trees again, either through natural regeneration or planting. The 34-year-old red pine plantation at the right has been thinned twice, illustrating the intensive management that probably will be commonplace in many stands in the future.

Growing-Stock Volume Up 40 Percent

Michigan's 1966 volume of growing stock was 15 billion cubic feet, a 40-percent increase over the 1955 volume. The biggest share of this volume (37 percent) was in the Northern Lower Peninsula Survey Unit (fig. 2). Timber volumes also increased faster in this Unit than in any other part of the State—a 70-percent gain between the two surveys. Growing-stock volumes increased in every Unit except the heavily urbanized and agricultural Southern Lower Peninsula.

Sawtimber volume increased 43 percent between 1955 and 1966, and reached 33.9 billion board feet.[1] The increase in the Northern Lower Peninsula was a phenomenally high 115 percent during this period. The following tabulation compares growing-stock and sawtimber volumes for 1955 and 1966:

Growing stock	*1955*	*1966*
	(Million cubic feet)	
Softwoods	2,594	3,838
Hardwoods	8,119	11,187
Total	10,713	15,025
Sawtimber	(Million board feet)	
Softwoods	6,399	9,702
Hardwoods	17,358	24,161
Total	23,757	33,863

The average volume per acre of growing stock jumped from 7 cords in 1955 to 10 cords in 1966. Similarly, the average volume per acre of sawtimber rose from 1,240 board feet in 1955 to 1,790 board feet in 1966.

The distribution of timber volume by Survey Unit was as follows:

Survey Unit	*Growing-stock volume* (Percent)	*Sawtimber volume* (Percent)
Northern Lower Peninsula	37	30
Western Upper Peninsula	29	31
Eastern Upper Peninsula	22	23
Southern Lower Peninsula	12	16
Total	100	100

Hardwoods make up 74 percent of the State growing-stock volume (table 1). The chief speci are aspen and hard maple (mostly sugar maple each of which constitutes 15 percent of the tot volume. Sugar maple is an extremely valuab species, and present demand for high-quality lo and bolts exceeds the current estimate of allo able cut for this species. Growing-stock volum of most of the major species groups in each the Survey Units has increased since 195 Hardwoods, especially hard maple and the oak dominate the sawtimber volume (table 2).

Between 1935 and 1955 heavy cutting of th northern hardwood type rapidly reduced th sawtimber volumes of sugar maple, yellow birc and hemlock (other softwoods) (fig. 3). Sin 1955 sawtimber volume of nearly all species e cept elm has increased because of the large num ber of trees that have grown to sawtimber siz The major reason for the decline in elm volum is probably Dutch elm disease.

Timber volume increased in every diamet class during the 11-year period, but the greate increases were in the smaller diameters. F example, the 1966 growing-stock volume in th 8-inch diameter class was 54 percent greater tha it was in 1955 (fig. 4). These accumulating tim ber volumes are evidence of the recuperativ phase Michigan's forests have enjoyed for th past several decades. This recuperative perio will probably continue at least for another decad and the volume in each diameter class shoul increase even more.

Fully two-thirds of the State's timber volum is in private ownership (individuals or com panies). Farmers and miscellaneous individua own more than half of the total growing-stoc volume, and forest industry owns another 1 percent.

In addition to the volume in growing-stoc trees, there is a sizeable volume in cull trees, an a small volume in salvable dead trees. Total ne volume of timber on commercial forest land 16,254.8 million cubic feet, of which 15,025. million cubic feet is growing-stock volume. Th nongrowing-stock volume, of which only a sma part is presently marketable, is distributed a follows:

Class of timber	*Volume* (Million cubic feet
Rough trees:	
Short-log trees	250.8
Other rough trees	679.0
Rotten trees	242.7
Salvable dead trees	57.3
Total	1,229.8

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[1] *International ¼-inch log rule.*

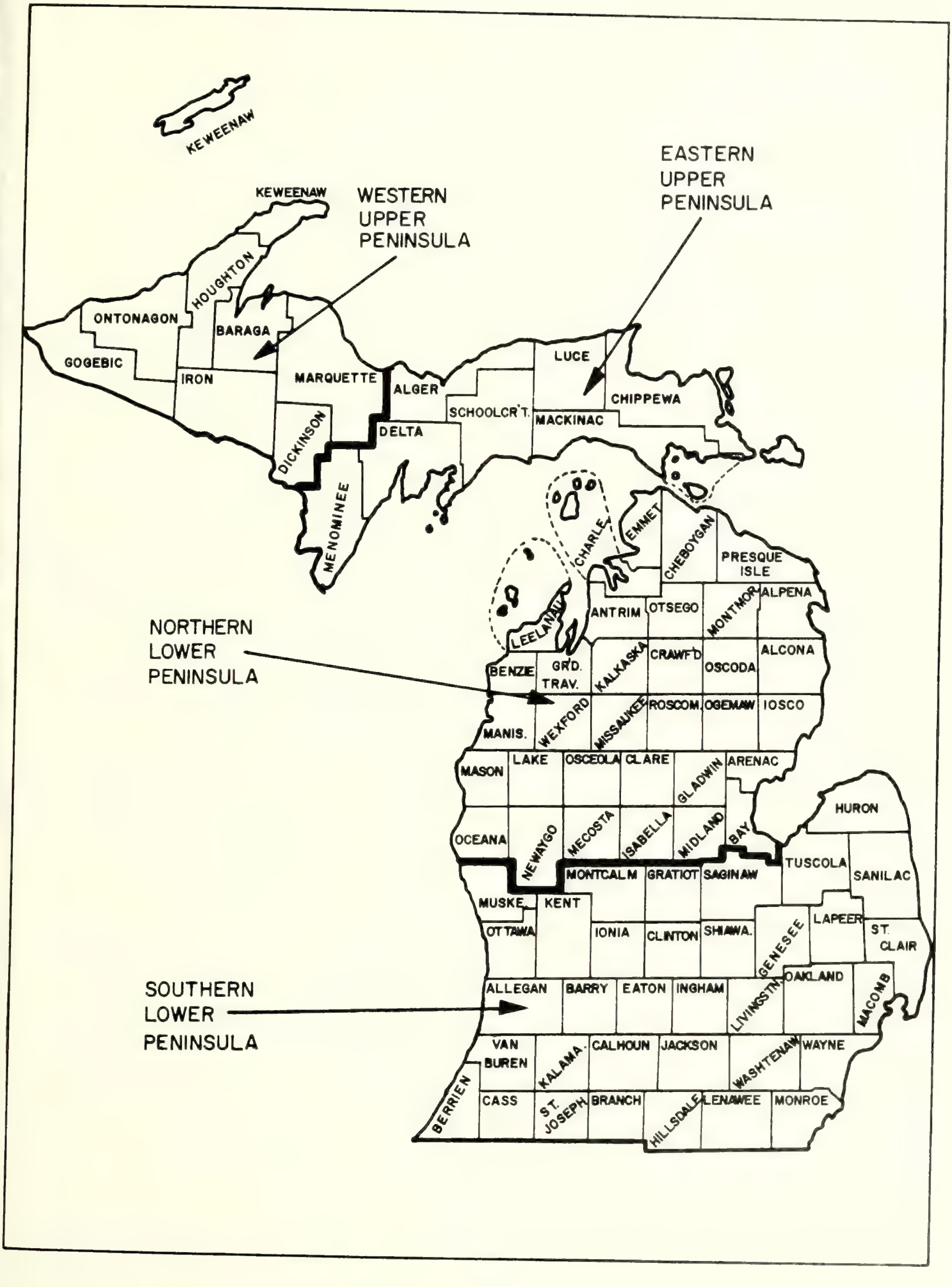

Figure 2.—Location of Forest Survey Units in Michigan, 1966.

Table 1.—Net volume of growing stock on commercial forest land by species group and percentage of total volume, Michigan, 1966

Species group	Growing-stock volume: Million cubic feet	Growing-stock volume: Percent
Pine	1,009.6	7
Spruce	517.1	3
Balsam fir	733.5	5
Hemlock	566.7	4
Northern white-cedar	922.3	6
Other softwoods	89.2	1
Total softwoods	3,838.4	26
Oak	1,556.8	10
Yellow birch	447.8	3
Hard maple	2,234.5	15
Soft maple	1,222.2	8
Ash	559.0	4
Paper birch	625.0	4
Aspen	2,257.1	15
Elm	751.4	5
Other hardwoods	1,532.8	10
Total hardwoods	11,186.6	74
All species	15,025.0	100

Table 2.—Net volume of sawtimber on commercial forest land by species group and percentage of total volume, Michigan, 1966

Species group	Sawtimber volume: Million board feet[1]	Sawtimber volume: Percent
Pine	3,267.5	10
Hemlock	2,793.8	8
Northern white-cedar	1,860.3	6
Other softwoods	1,780.5	5
Total softwoods	9,702.1	29
Oak	4,123.2	12
Yellow birch	1,473.0	4
Hard maple	5,830.1	17
Soft maple	2,382.4	7
Basswood	1,051.0	3
Beech	1,571.7	5
Aspen	2,684.0	8
Elm	1,942.5	6
Other hardwoods	3,103.3	9
Total hardwoods	24,161.2	71
All species	33,863.3	100

[1] International 1/4-inch rule.

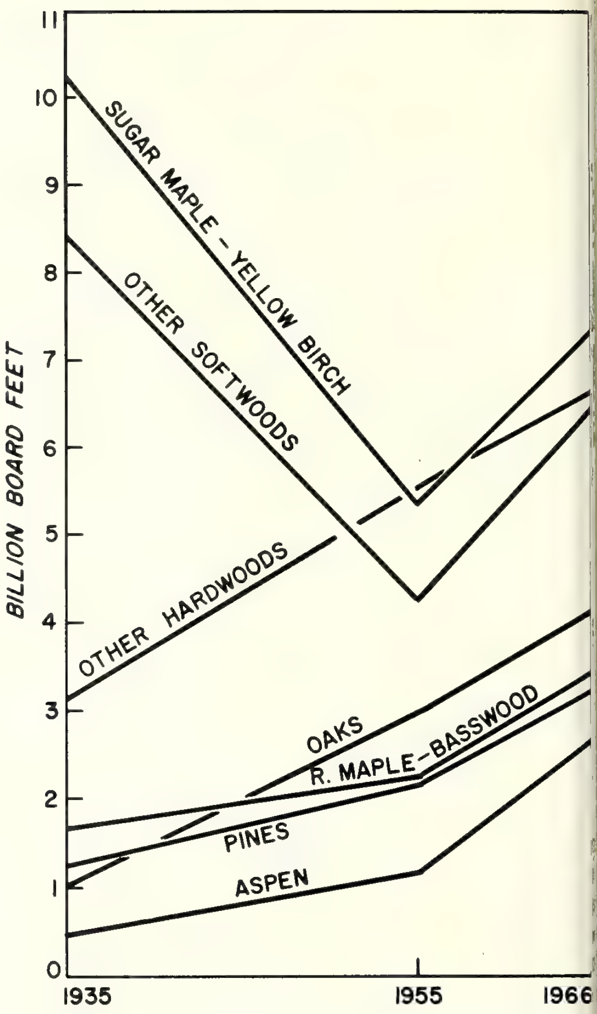

Figure 3.—Change in sawtimber volume between surveys by species group, Michigan, 1966.

The quality of Michigan's sawtimber tree was estimated by grading the butt log of abou one-third of the sawtimber trees sampled durin the 1965 survey. (Log grade standards used f each species are described in the Appendix.) Th estimated percentage of butt logs in each lo grade is shown in the following tabulation:

	Softwoods	*Hardwoods*
Grade 1	3	21
Grade 2	8	37
Grade 3	82	40
Grade 4	7	2
Total	100	100

The above information is more meaningf if it is converted into the "log grade mix" tha the whole tree should yield. This is true becaus the butt log usually contains the highest grad log in a tree and about 45 percent of the whol

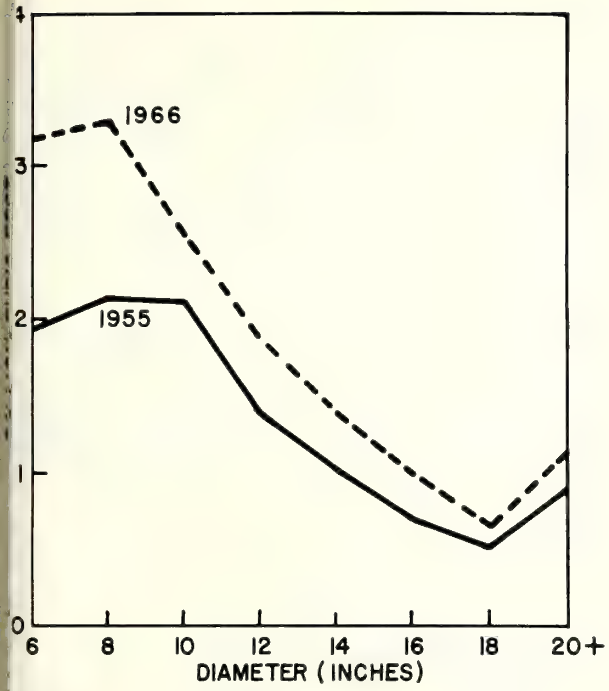

Figure 4.—Distribution of growing-stock volume by diameter class, Michigan, 1955 and 1966.

ee volume in northern hardwoods. A study[2] nducted by the Michigan Technological Uni- rsity provided a means of making this conver- on for hardwoods, but similar information for ftwoods is not yet available. The percentage hardwood-tree volume in each log grade is ractically the same as the percentage of butt gs in each grade:

	Hardwoods
Grade 1	18
Grade 2	37
Grades 3 and 4	45
Total	100

Growth Is on the Upswing

Net annual growth on growing stock was 580 illion cubic feet in 1965, an 18-percent gain ver that of 1954. Nearly one-fourth of the net rowth was ingrowth, the net volume of small rees that grew into poletimber size during the ear. The remainder of the growth was incre- ent on trees already 5 inches d.b.h. (diameter t breast height) and larger:

	Net annual growth on growing stock (Thousand cubic feet)
Ingrowth	133,386
Growth on growing stock	446,171
Net growth	579,557

The net annual growth rate in 1966 averaged a respectable 3.9 percent of the inventory of growing stock, about 1 percent less than in 1954. Growth rates for individual species ranged from 10 percent for red pine to about 1 percent for hemlock and elm.

A high volume of mortality prevented net growth from being higher (because mortality is subtracted from gross growth to arrive at net growth). Mortality in 1965 was equal to about 30 percent of the gross growth:

	Thousand cubic feet
Gross growth	823,410
Mortality	243,853
Net growth	579,557

However, two-thirds of the above mortality is concentrated in four species. Quaking aspen alone accounted for 32 percent of the mortality, balsam fir 11 percent, elm 10 percent, and bigtooth aspen 9 percent. Table 3 shows the effect mortality had on the net growth of these four species in 1965.

Table 3.—Volume of growing-stock gross growth, mortality, and net growth for selected species, Michigan, 1965
(In thousand cubic feet)

Species	Gross growth	Mortality	Net growth
Quaking aspen	112,841	78,640	34,201
Balsam fir	55,759	25,737	30,022
Bigtooth aspen	50,425	22,288	28,137
Elm	30,742	23,972	6,770

Diseases were responsible for almost half of the mortality. Hypoxylon canker (affecting aspen) and Dutch elm disease were two of the most serious diseases. Other causes of mortality were insects, suppression by trees or other vegetation, and a variety of less common causes. Short-lived species like aspen and balsam fir are sometimes too scattered to be economically available for harvest; therefore, they suffer much loss from overmaturity.

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[2] *Meteer, J. W. Butt log tree grades ana- yzed. Mich. Tech. Univ., Ford Forest. Center, es. Note 2, 8 p. 1966.*

The 2 billion board feet of net annual growth of sawtimber in 1965 represents a 75-percent gain over the 1954 growth. Less than 10 percent was ingrowth:

	Net annual growth on sawtimber (Thousand board feet)
Ingrowth	131,863
Growth on sawtimber	1,856,787
Net growth	1,988,650

The sawtimber net annual growth rate was 5.9 percent of the inventory—somewhat higher than for growing stock.

Sawtimber mortality was 21 percent of gross growth, compared with 30 percent for growing stock mentioned earlier:

	Thousand board feet
Gross growth	2,524,315
Mortality	535,665
Net growth	1,988,650

The four species with the greatest volume of sawtimber mortality were quaking aspen, bigtooth aspen, elm, and hemlock (table 4). Quaking aspen accounted for 22 percent of the total sawtimber mortality and had the highest mortality rate (7.2 percent of its sawtimber inventory).

Table 4.—Volume of sawtimber gross growth, mortality, and net growth for selected species, Michigan, 1965
(In thousand board feet)[1]

Species	Gross growth	Mortality	Net growth
Quaking aspen	294,421	118,521	175,900
Bigtooth aspen	168,355	55,915	112,440
Elm	118,946	78,646	40,300
Hemlock	84,602	32,332	52,270

1/ International 1/4-inch rule.

Maple-Beech-Birch is Predominant Forest Type

Figure 5.—A thinned maple poletimber stand. Th maple-beech-birch forest type has the larges area of any type in Michigan. Also, poletimbe is the most extensive stand-size class in th State. (Photo courtesy of Kimberly-Clar Corporation.)

The maple-beech-birch type is found on 5.2 million stocked acres, or on 28 percent of the stocked commercial forest area (fig. 5). The next most extensive forest type is aspen-birch with 4.5 million stocked acres.[3] During the 1935 an 1955 surveys the aspen-birch type covered th largest area (fig. 6), but in 1966 it slipped t second place. Aspen, a pioneer species, becam established on many burned-over areas in Mich gan. Decline of the aspen-birch type, then, is du partly to natural plant succession as more shad tolerant species replace these postfire specie Inadequate harvesting of mature and overmatur aspen-birch stands, and premature harvest immature stands, have probably also contribute to this decline.

The other four major forest types occup much smaller areas and are less widely distrib uted over the State (see forest type map insid back cover).

Most of Michigan's timber stands are young—half of them are under 40 years old and anothe third are between 40 and 70 years of age. Th average rotation age, or age at which matur timber in a stand is harvested, is different f each forest type. A short-lived species like jac pine should be harvested much sooner than long-lived species like sugar maple to avoid ex cessive mortality. Nearly every forest type ha

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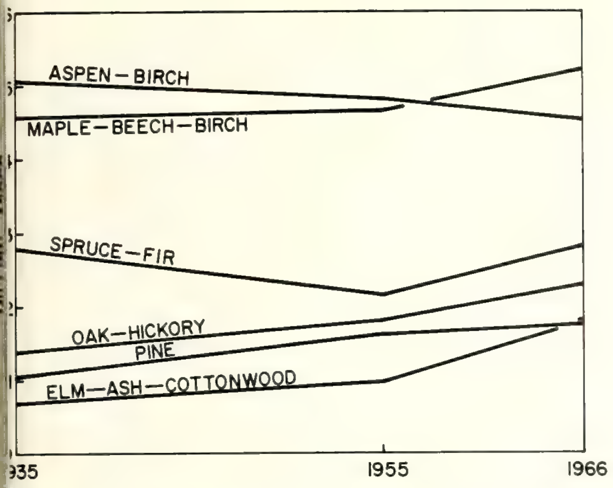
[3] *The forest-type areas shown in figure do not agree with those given in the Appendi tables because the tables include nonstocke areas within each type. Nonstocked areas wer not classified as to forest type in 1935 an 1955.*



gure 6.—Area of stocked commercial forest land by forest types, Michigan, 1935, 1955, and 1966.

me stands that are overmature (over rotation ge), and for every type the distribution of area age classes is less than ideal. An ideal evenged forest would have an equal area of each pe in each 10-year age class, and have no overature timber.

The present stand-age distributions of some the forest types in the State are compared ith the desirable distributions in figure 7. The aphs indicate relatively large areas of overma- ure aspen and cedar, and accelerated harvesting mature and overmature stands of these types highly desirable.

Overall Stocking is Good, But "Desirable" Trees in Short Supply

Tree stocking is expressed as a percent of the inimum stocking required to make full use of e site. Stocking is measured in terms of basal ea per acre for trees 5.0 inches d.b.h. and larger numbers of trees per acre for smaller trees. On is basis, the stocking of all live trees (growing- ock and cull trees) and of growing-stock trees high in Michigan. Seventy percent of the com- ercial forest area is well stocked (70 percent ocking or more) with live trees and 51 percent well stocked with growing-stock trees. Only 9 ercent of the area is lightly stocked (10 to 40 ercent stocking) with live trees and 16 percent lightly stocked with growing-stock trees. How- ver, 15 percent of the commercial forest area was ore open than tree-covered (less than 50 percent ocked). Also, 27 percent of the area was less an 50 percent stocked with growing-stock ees.

In contrast, the stocking of "desirable"[4] trees—those healthy, vigorous, defect-free trees that are most likely to produce valuable products and survive to maturity—is very low. Only about 1 percent of the commercial area is well stocked with desirable trees, while 46 percent of the area is lightly stocked with them.

The kind of trees land managers prefer as timber crop trees are scattered sparsely over Michigan's generally thick forests. However, the number of desirable trees should increase as protection from fire, insects, and disease continues to improve and as better cutting practices and timber stand improvement efforts pay dividends.

Another way of assessing the condition of the forests in Michigan is to look at the proportion of cull trees. Almost 20 percent of the live trees are cull (rough or rotten) trees that presently have little or no commercial value, although they occupy growing space (fig. 8):

	Percent of all live trees
Growing stock trees (over 1 inch d.b.h.):	
Saplings (1 to 5 inches d.b.h.)	51
Poles and sawtimber trees:	
Desirable	7
Acceptable	23
Cull trees:	
Rough trees (over 1 inch d.b.h.)	16
Rotten trees (over 1 inch d.b.h.)	3
All live trees (over 1 inch d.b.h.)	100

Three-fourths of all sound, live trees at least 1 inch in d.b.h. are small—less than 5 inches d.b.h. As mentioned earlier, many stands in Michigan are young. The small, vigorous trees usually associated with such stands represent a high potential for the State's forests.

The methods for determining the potential productive capacity of forest land are still being developed, but site index[5] provides some idea of the present productivity of these lands. The most productive land usually grows the tallest

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[4] *Live trees are classed by Forest Survey as either desirable, acceptable, rough, rotten, or short sawtimber. See Appendix for definitions.*

[5] *Site index is the height in feet of average dominant and codominant trees at 50 years of age. For example, "site index 60" for red pine means that the height of dominant or codominant trees in that area average 60 feet at 50 years of age.*

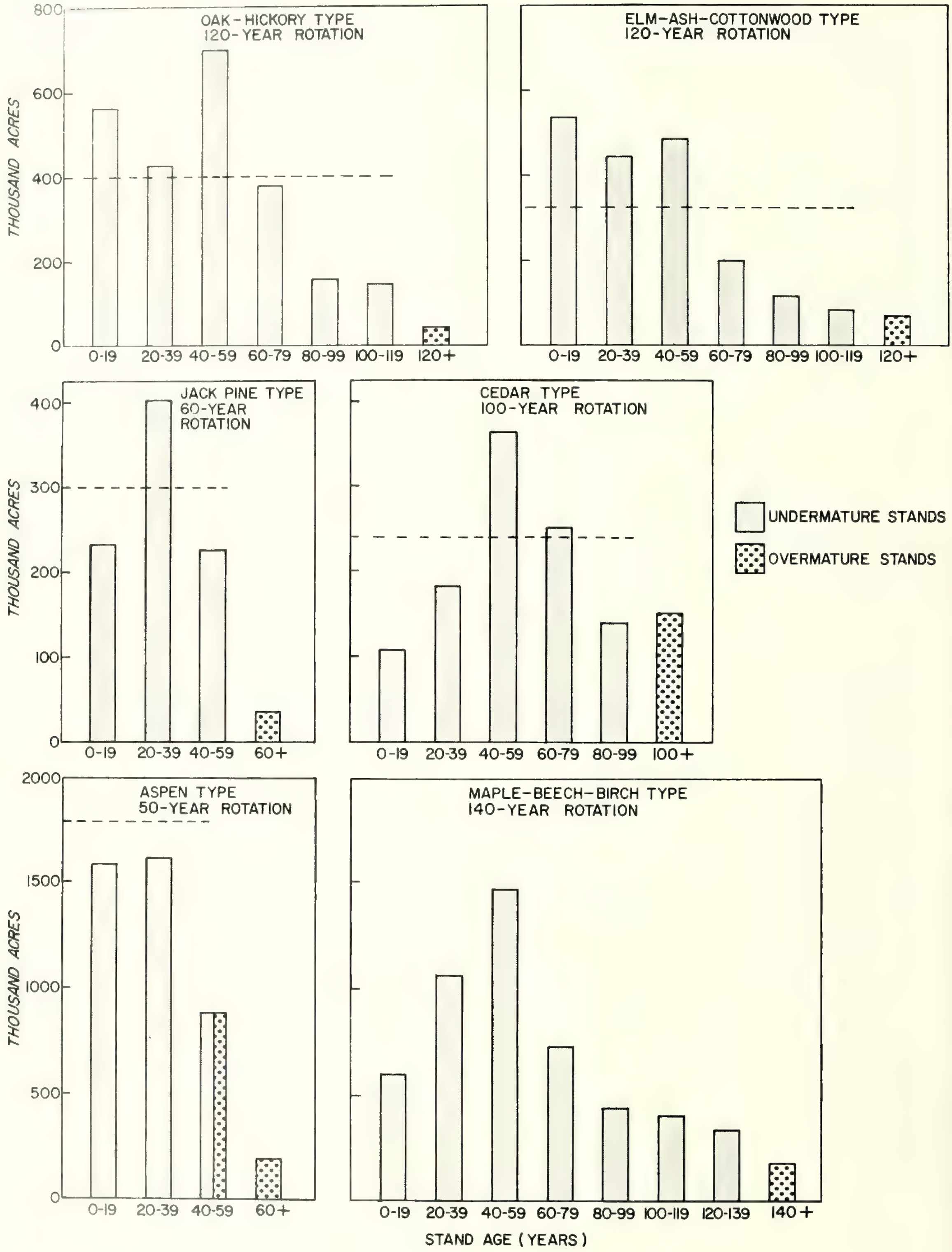

Figure 7.—Area of forest types by stand-age class and desirable area based on rotations suggested for average sites in Michigan, 1966. Broken lines show desirable level for rotation shown. (No desirable level shown for the maple-beech-birch type because this type is usually managed under all-aged conditions.)

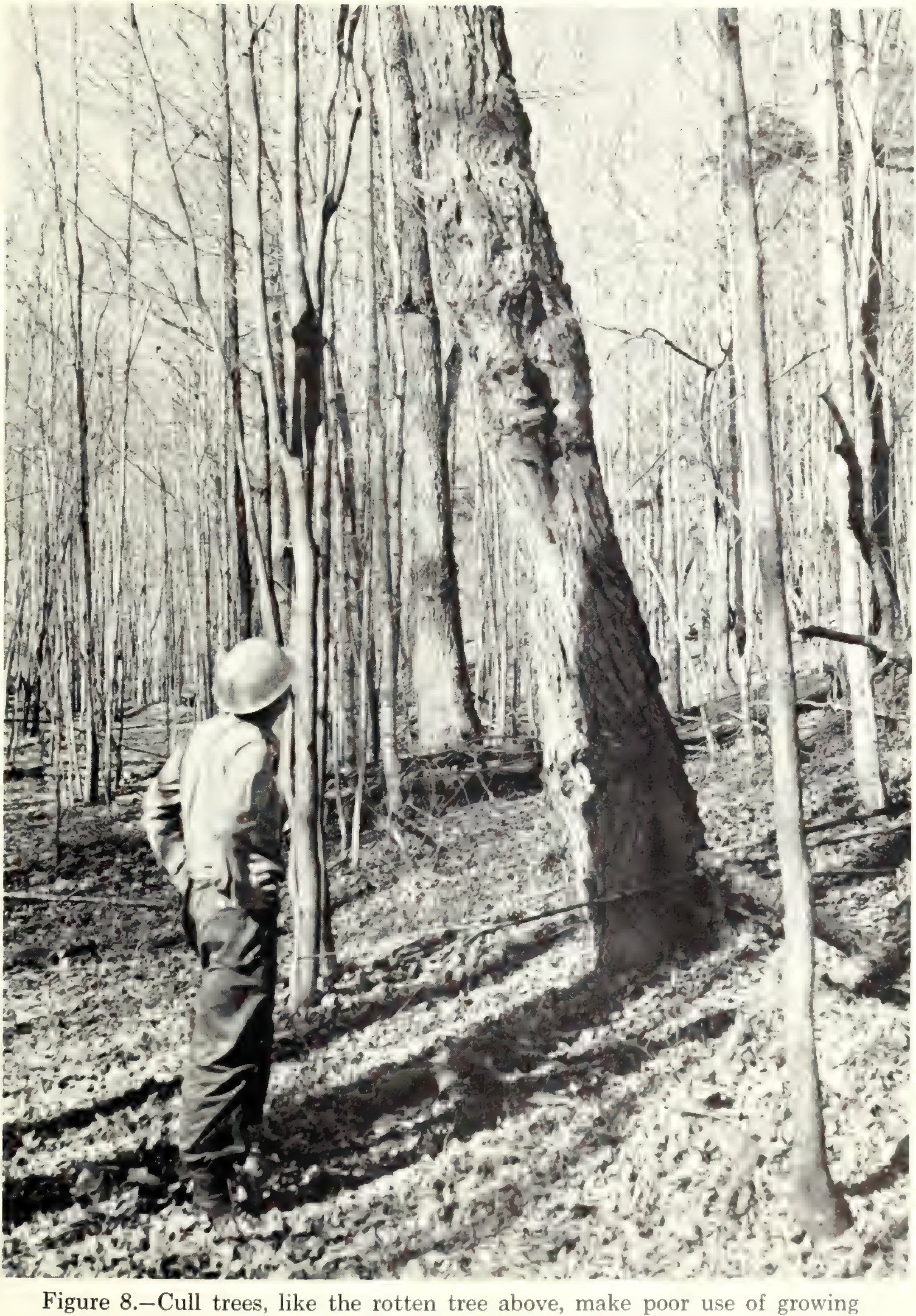

Figure 8.—Cull trees, like the rotten tree above, make poor use of growing space and contain a smaller amount of usable wood than growing-stock trees. Cull trees account for 19 percent of the total number of live trees in Michigan, but only 7 percent of the cubic-foot volume. The benefits from removing such trees are obvious. (Photo courtesy of Michigan Department of Natural Resources.)

trees at a given index age (50 years in this report). Site index varies widely by species, but forest land in the Midwest can be described roughly as follows:

	Site index class
Poor	55 or less
Average	56 to 70
Good	More than 70

Using the above classification, in 1966 almost 20 percent of Michigan's commercial forest area was comprised of good sites and 40 percent was comprised of average sites.

Commercial Forest Area Declining

The area of commercial forest land in Michigan changed from 19.0 million acres in 1935 to 19.1 million acres in 1955, and declined to 18.9 million acres in 1966. Although these differences are minor, the long-term trend seems to be toward a declining area as the commercial forest gives way to highways, powerlines, reservoirs, and urban, recreational, and industrial developments. This withdrawal is only partially offset by reforestation of crop and pasture land (fig. 9).

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Figure 9.—Newly planted red pine seedlings in Wexford County. Despite a vigorous tree planting program (over 1-1/4 million acres planted), the commercial forest area in Michigan continues to decline because of competing needs for land by an increasing population.

During the last 12 years the commercial forest area has declined an average of 18,400 acres per year. Estimates of future commercial area suggest that this reduction will accelerate to about 44,000 acres per year over the next three decades.

The change in commercial forest area was not uniform throughout the State – it decreased slightly in the Upper Peninsula, decreased considerably in the Northern Lower Peninsula, and increased considerably in the Southern Lower Peninsula. The latter increase was probably due to idle cropland and pasture returning to forest, widespread tree planting on open land, and decreasing use of farm woodlots for pasture.

Increases in commercial forest area do not immediately bring about corresponding increases in timber volume, although loss of commercial area does usually result in immediate loss of timber volume. Lands added to the commercial forest are principally stocked with seedlings and saplings, and therefore contain little volume. This could explain why commercial forest area increased by 400 thousand acres in the Southern Lower Peninsula between 1955 and 1966, and yet timber volume dropped. In the other three Units increasing timber volumes were large enough to allow net volume gains despite net area losses.

The Upper Peninsula is the most heavily forested part of Michigan (fig. 10). Commercial forests grow on more than three-fourths of the land area of each county in the Upper Peninsula except Keweenaw County, where Isle Royale National Park has been reserved for recreational use. Most counties of the Northern Lower Peninsula are more than 50 percent commercial forest. Even in the agricultural and urbanized Southern Lower Peninsula only one county (Wayne) is less than 10 percent commercial forest land. Over the State, commercial forests constitute 52 percent of the total land area.

Poletimber Becomes Dominant Stand-Size Class

In 1966 poletimber stands represented 43 percent of Michigan's commercial forest area, more than any other stand-size class. In 1955 sapling and seedling stands covered 36 percent of the area, and poletimber stands accounted for only 32 percent. Table 5 shows the advance of trees into larger diameter classes as the dominant stand-size class changed from sapling and seedling in 1935 to poletimber in 1966.

Much of what appears to be a dramatic reduction in nonstocked area between 1955 and 1966 is not actual change. Improved sampling procedures used in the latest survey, which require more precise determination of the presence or absence of trees on the sample location, have given more accurate information on the amoun

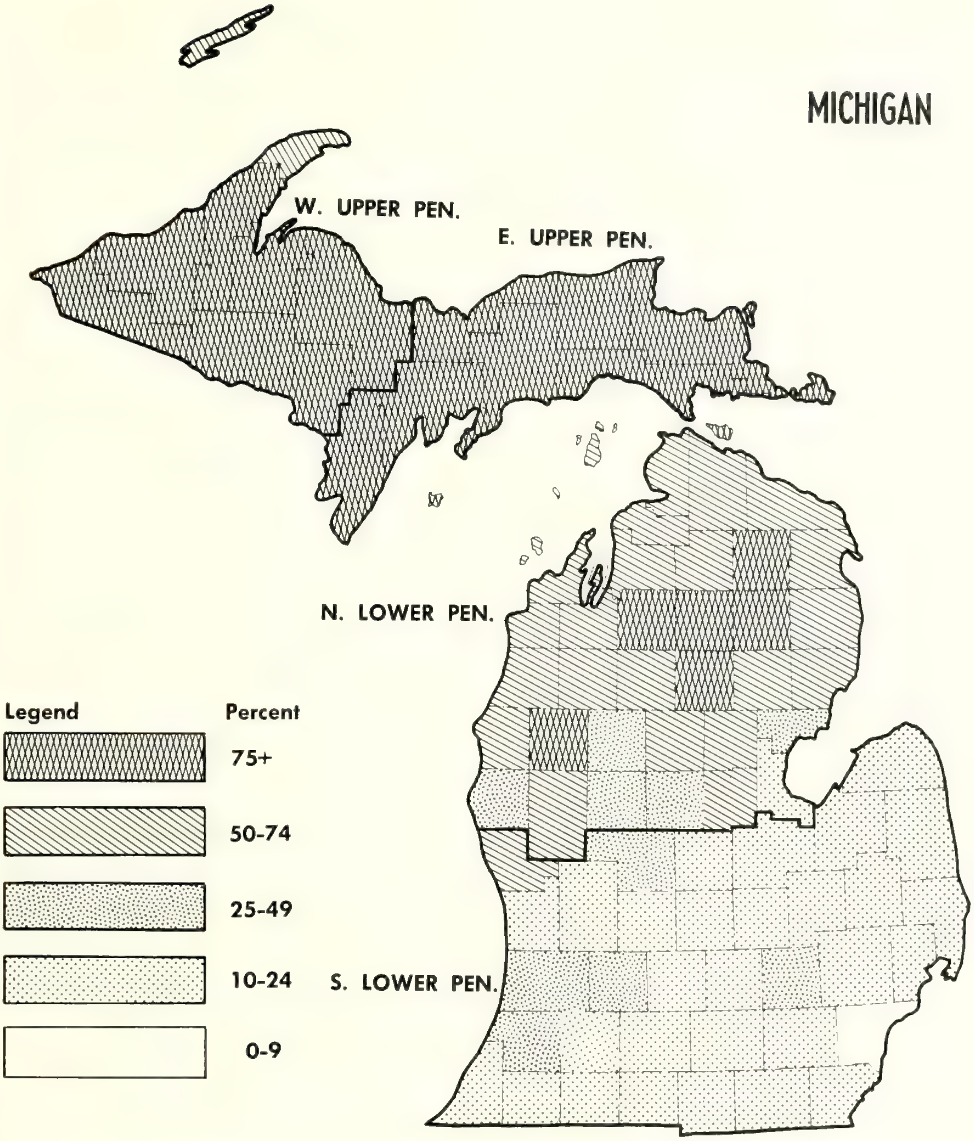

Figure 10.—Commercial forest area as a percent of all land area, 1966.

able 5.—Area of commercial forest land by stand-size class in Michigan, 1935, 1955, and 1966

(In thousand acres)

Stand-size class	1935	1955	1966
Sawtimber	3,151	3,008.1	4,723.2
Poletimber	3,404	6,119.6	8,205.8
Sapling and seedlings	8,913	6,845.4	5,432.8
Nonstocked areas	3,582	3,147.8	538.4
Total	19,050	19,120.9	18,900.2

of nonstocked commercial forest land. Unfortunately, however, meaningful comparisons of the areas of nonstocked forest in 1955 and 1966 cannot be made because of this changed procedure. It is certain that the nonstocked area has decreased between surveys as a result of natural regeneration and, to a lesser extent, tree planting. However, some formerly stocked commercial forest land has become nonstocked as a result of the failure of natural regeneration following timber harvesting on some jack pine and aspen sites.

TIMBER USE

Growing-Stock Removals Gained Since 1954

Growing-stock removals from commercial forest land in 1965 were estimated to be 206 million cubic feet, a 16-percent increase over 1954 removals. Timber removals include not only trees harvested, but trees cut or destroyed by thinnings, land clearing, or changes in land use.

About one-third of the 1965 removals came from the Northern Lower Peninsula; this Unit also showed the largest increase (about 70 percent) in removals since 1954. During the same period, removals in the Southern Lower Peninsula dropped 23 percent. Hardwoods, chiefly the aspens, accounted for three-fourths of the volume removed.

Growing-stock removals in 1965 amounted to about 1.4 percent of the inventory and about 36 percent of the net growth. Under ideal conditions, timber removals would closely approach or equal net growth. However, because only a portion of the growth can be cut in Michigan's young and rebuilding forests, a direct comparison between growth and removals is of little value. A better comparison is between allowable annual cut and timber removals. Allowable (desirable) annual cut is the average net volume of timber that it is advisable to cut annually on commercial forest land to maintain or increase the level of growing stock and to bring about a better distribution of age classes. The annual cut is calculated for a 10-year period, and includes harvest and improvement cuts yielding 3 cords or more per acre and one-tenth of the entire net volume of stands beyond rotation age. Annual allowable cut is determined on the basis of total commercial volume present regardless of its current economic availability. An unknown amount of the allowable cut volume is unavailable for logging because of location, quality or quantity of the timber, lack of markets, or unwillingness of some owners to sell. For these reasons allowable cut can only be used as a guide to compare with timber removals.

Removals of Growing Stock Far Below Allowable Cut

Michigan's annual allowable cut from growing stock between 1966 and 1975 will be an estimated 380 million cubic feet, compared with 206 million cubic feet of actual removals in 1965. Timber removals can be increased about 84 percent above the 1965 level and still be within the allowable cut. Removals can be more than doubled in the Eastern Upper Peninsula and almost doubled in the Western Upper and Northern Lower Peninsula, but are presently about 45 percent greater than allowable cut in the Southern Lower Peninsula.

The 1965 sawtimber removals amounted to 823 million board feet, 50 percent more than in 1954. These removals were 2.4 percent of the current sawtimber inventory and 40 percent of the current net growth. The aspens provided 23 percent of the sawtimber removals, followed by sugar maple with 16 percent and elm with 8 percent. The Western Upper Peninsula and the Northern Lower Peninsula each contributed about 30 percent of the State's sawtimber removals. The other two Units each provided approximately 20 percent of the total removals.

Sawtimber removals in 1965 were about 90 percent of the allowable annual cut, which was estimated to be 910 million board feet. Even though removals were close to the allowable cut over the State as a whole, the situation in individual Survey Units was less satisfactory. Sawtimber removals in the Southern Lower Peninsula were about 80 percent greater than allowable cut, and removals in the Upper Peninsula were nearly 30 percent less than allowable cut. The overcutting in the Southern Lower Peninsula is the result of rapid urbanization and consequent timber harvesting on lands slated for development, and the effect of increasingly shorter tenure of ownership.

When the volumes of removals and allowable cut for each species are compared, the underutilized species (removals less than allowable cut) may be separated from the overutilized ones (removals greater than allowable cut) (table 6).

The growing-stock harvest of every species except jack pine could be increased. On the other hand, sawtimber removals are greater than allowable cut for a number of species – most notably elm, hard maple, aspen, and jack pine (fig. 11). For several species this apparent overcutting of sawtimber trees is not a problem, but for other species it is a matter of some concern. For example, elm presents a special case because of present and expected high mortality due to Dutch elm disease. This disease is particularly severe in the southern portion of the Lower Peninsula. It has not yet killed a large volume of elm in the Upper Peninsula, but it may do so in the future ble 6.—*Volume of growing stock and sawtimber underutilized and overutilized by species, Michigan, 1965*

Species	Underutilized		Overutilized	
	Growing stock	Sawtimber	Growing stock	Sawtimber
	Thousand cu. ft.	Thousand bd. ft. 1/	Thousand cu. ft.	Thousand bd. ft. 1/
hite and red pine	9,711	49,001	--	--
ack pine	--	--	5,592	32,680
pruce	10,095	10,020	--	--
alsam fir	25,642	18,039	--	--
orthern white-cedar	29,591	89,231	--	--
emlock	7,129	32,359	--	--
ak	3,415	--	--	10,162
ellow birch	3,660	--	--	1,010
ard maple	15,870	--	--	16,772
oft maple	13,983	5,927	--	--
eech	4,200	11,797	--	--
sh	6,456	4,939	--	--
alsam poplar	9,680	21,670	--	--
spen	14,682	--	--	2/ 69,974
asswood	4,318	--	--	1,489
lm	2,216	--	--	26,754
aper birch	14,770	5,657	--	--
ther species	2,628	--	--	2,506

1/ International 1/4-inch rule.

2/ It is usually desirable to harvest aspen sawtimber as oon as trees become mature to prevent excessive mortality. his species becomes mature on average sites soon after reaching awtimber size.

nless an efficient means of control is found. Elm movals in 1965 were far below allowable cut in e Upper Peninsula but far above allowable cut the Lower Peninsula, reflecting the pattern f spread of the disease. The present estimate r allowable cut of elm in the Lower Peninsula probably too low, because the area control ethod that was used to calculate allowable cut oes not properly cope with a situation where isease threatens to virtually eliminate a species. more meaningful allowable cut for elm in the Lower Peninsula would probably be close to the volume currently being removed.

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igure 11.—Tractor operator releasing tongs from mature sugar maple saw logs after skidding them out to a logging road. Sawtimber removals over the State in 1965 were only slightly less than the estimated annual allowable cut. Sugar maple sawtimber removals, however, were greater than allowable cut.

Also, because aspen on average sites usually matures soon after reaching sawtimber size and begins to suffer heavy defect and mortality losses, it is desirable to harvest sawtimber trees as quickly as possible. The same is not true on superior sites where healthy trees can be grown for longer periods of time.

The overcutting of jack pine is a serious problem, however, and represents a big drain on the inventory of this species.

Roundwood Output Gains — Especially Pulpwood

After a long history of general decline, the output of roundwood products (all timber products from roundwood such as logs, bolts, and limbwood) in Michigan may be ready for a period of increase (fig. 12). As discussed in the following paragraphs, the primary reason for this optimistic outlook is that pulpwood output is expected to continue to climb. Comparison of output in 1965 with that in 1954 shows a 68 percent increase for pulpwood, and decreases for all other major products. Pulpwood constituted more than half of the State's roundwood output in 1965:

Products	*Output* (Million cu. ft.)	*Percent*
Pulpwood	103.8	52.8
Saw logs and bolts	57.2	29.1
Miscellaneous industrial wood	6.8	3.4
Veneer logs and bolts	3.1	1.6
All other products	25.8	13.1
All products	196.7	100.0

It is likely that the output of pulpwood will continue to expand, especially since technology now permits use of hard hardwoods in the pulping process. The short wood-fiber length, which characterizes this group of species, previously limited use of hard hardwoods as pulpwood. But because pulpwood demand is increasing, industry is adapting to the use of short-fibered species.

Pulpwood output increased in every Survey Unit between 1954 and 1965, but it gained most rapidly in the Northern Lower Peninsula, where 40 percent of the State's pulpwood was produced in 1965. Pulpwood harvesting per unit of stocked commercial forest was most intense in Isabella and Menominee Counties. The 1965 output of saw logs and bolts was higher than the 1954

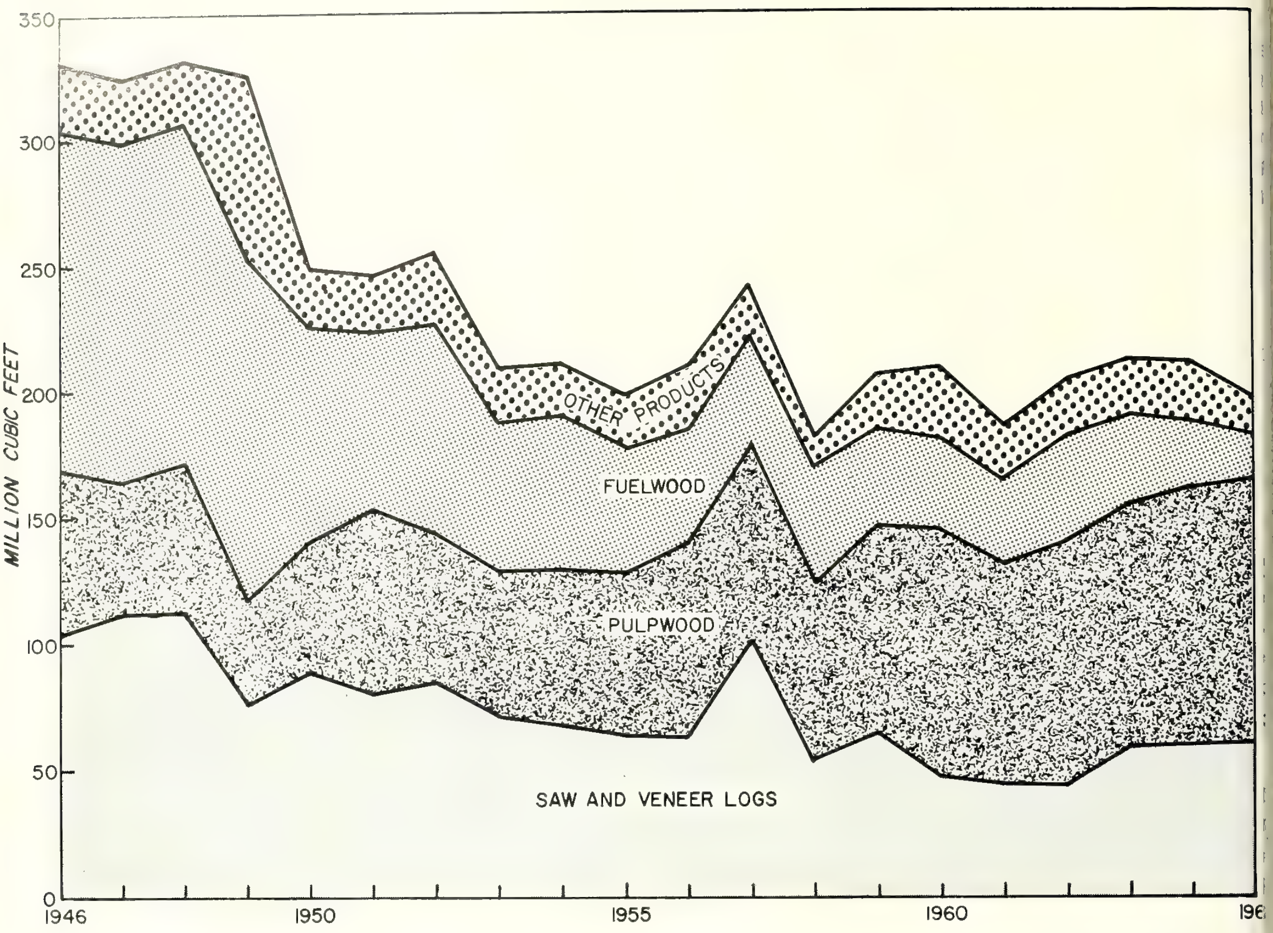

Figure 12.—Output of roundwood products in Michigan, 1946 to 1965. Points for some years are based on trend-level curves because survey data are not available for every year.

output in the Lower Peninsula, but lower than the 1954 amount in the Upper Peninsula. Output in the Southern Lower Peninsula doubled, accounting for one-third of the State's total production of saw logs in 1965. Veneer-log and bolt production, half of which came from Western Upper Michigan in 1965, dropped in all Units except the Northern Lower Peninsula.

Some idea of the importance of the forest to Michigan's economy is seen in the value of the rough forest products delivered to the mill. In 1965 these products were worth an estimated $50.9 million. Pulpwood accounted for about 47 percent of this total value, saw logs 37 percent, and other products 16 percent.

An estimated 19,350 man-years of employment were provided in primary timber-based jobs in Michigan during 1965 – including timber harvesting (6,850 man-years), primary manufacturing (9,300 man-years), and forest management (3,200 man-years). The pulp and paper industr provided most of the jobs – 45 percent of th timber harvesting employment and 43 percent the manufacturing employment. Timber harves ing workers earned more than $25 million in 196 and timber-based primary manufacturing en ployees earned more than $50 million. Thos engaged in forest management work earned $1 million.

Most of Michigan's Roundwood Export Go to Wisconsin

One-quarter of the volume of roundwood tha is harvested in Michigan is exported to oth States or Canada for manufacture or processin Most of these exports are pulpwood, but sma amounts of saw logs and veneer logs are als shipped out of State. In 1965 primary mills i Michigan consumed only 131 million cubic fe f an output of 171 million cubic feet. These igures and those in the tabulation below do not nclude piling, poles, mine timbers, posts, or uelwood, because consumption data are not vailable for these products. The following tabulation shows output and consumption in 1965 or major forest products:

Product	*Output*	*Consumption*
	(Million cubic feet)	
Pulpwood	103.8	65.2
Saw logs and bolts	57.2	57.4
Miscellaneous industrial wood	6.8	6.8
Veneer logs and bolts	3.1	1.7
All products	170.9	131.1

Two-thirds of the veneer logs and virtually ll of the saw logs and pulpwood exported from Michigan were shipped to plants in Wisconsin. Michigan imported some veneer logs and pulpvood, but the volume imported was only a fraction of that exported. Saw log imports, however, were slightly greater than exports.

Between 1954 and 1965, consumption of veneer logs fell about 60 percent and saw logs about 20 percent. During the same period consumption of pulpwood doubled and there was a gain of 14 percent in the use of miscellaneous industrial wood, resulting in a net increase in total consumption in 1965 over that of 1954.

Every Survey Unit had an excess of output over consumption in 1965 except the Southern Lower Peninsula (fig. 13). For the Lower Peninsula as a whole, however, output and consumption were nearly equal.

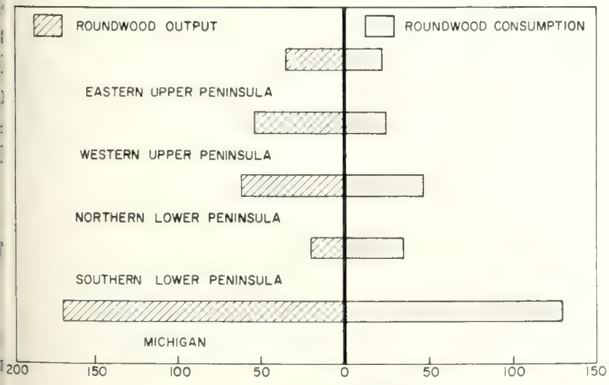

Figure 13.—Comparison of roundwood output and consumption by Forest Survey Unit, Michigan, 1965.

Total roundwood output in 1965 amounted to 196.7 million cubic feet, somewhat lower than the 227.5 million cubic feet in 1954. These two figures include volumes for piling, poles, mine timbers, posts, and firewood.

Roundwood Consumption Rises Despite Decline in Number of Small Mills

Between 1954 and 1965 the number of primary wood-using plants in Michigan plummeted from 2,100 to 437 (fig. 14). In general, the plants that closed were smaller and less efficient than those that remained in operation.

By 1965, only 266 out of 1,866 [6] small sawmills that had operated in 1954 were in production. The number of large and medium-sized sawmills increased from 96 to 122 during the same period, with increases in every Survey Unit except the Western Upper Peninsula.

The number of pulpmills in Michigan dropped from 11 to 10 in the 11 years between surveys. The Eastern Upper Peninsula and Southern Lower Peninsula each lost one pulpmill, and the Western Upper Peninsula gained one. Pulp production per mill increased significantly since 1954. Prospects for increased pulpmill capacity and number of mills in the near future are good. Some present mills are planning on expanding and at least one company is considering a new plant. Pulping processes that permit use of short-fibered hardwoods will probably receive high consideration in any new expansion planning.

Nearly half of Michigan's veneer mills shut down between 1954 and 1965, the number of mills decreasing from 23 to 12. All of the mills that closed were container veneer mills that produced material for cartons and boxes to be used largely for produce. When paper and plastic containers began to dominate the market, those container veneers mills that could not shift to supplying other markets were forced to close. Six of the mills that closed were in the Southern Lower Peninsula and four were in the Eastern Upper Peninsula. The number of face and core veneer mills in the State remained at four.

Closure of miscellaneous primary wood-using plants was especially severe. Between 1954 and 1965, their numbers tumbled from 102 to only 26, the decline being general throughout the State. Only 1 particleboard mill, 1 shingle mill, 1 special-

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[6] *A small but unknown number of these small sawmills were idle in 1954.*

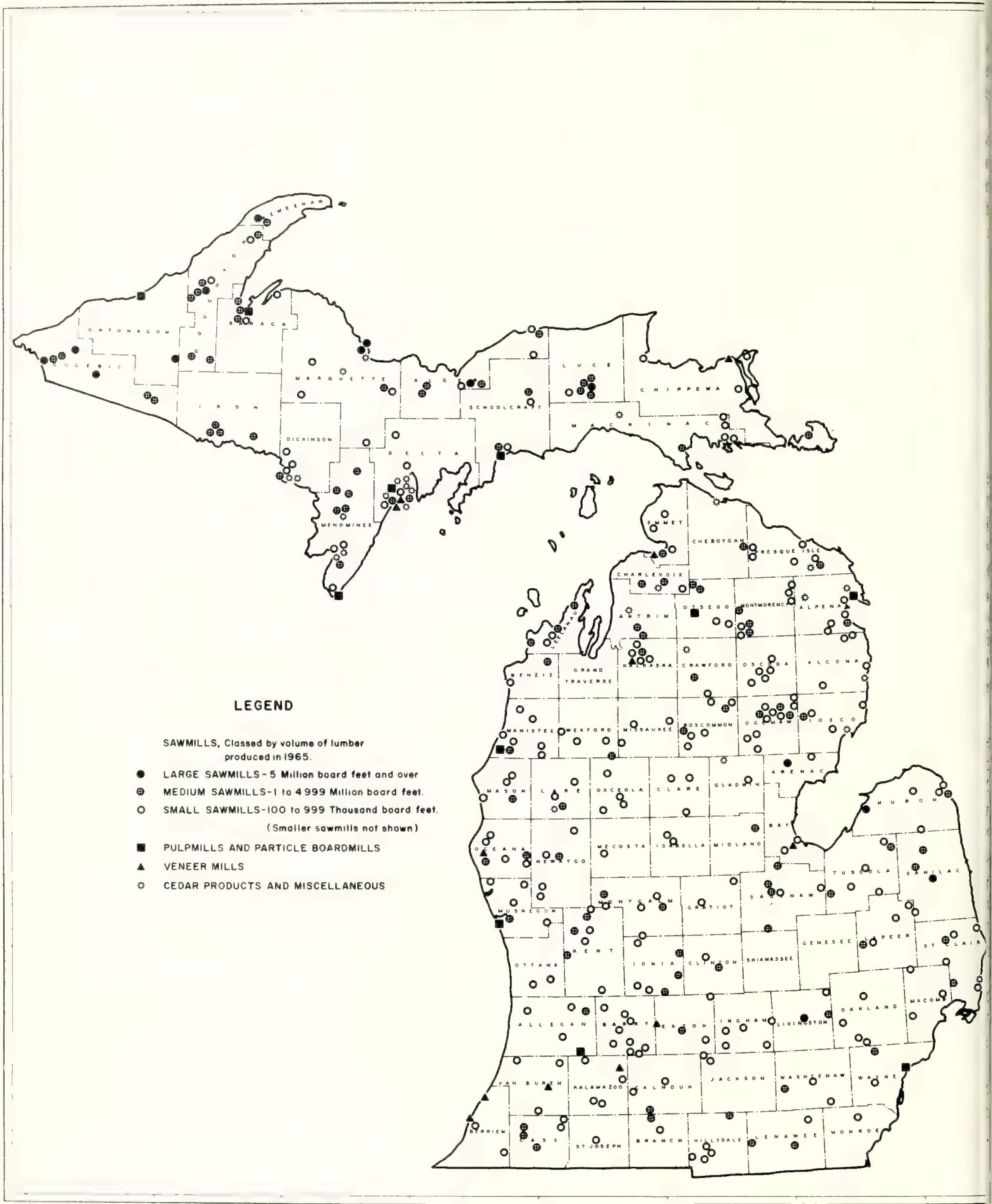

Figure 14.—Primary wood-using mills and plants by type of mill and county, Michigan, 1965.

plant, 1 combination post and pole yard and nce plant, 2 wood-turning plants, 5 log cabin anufacturing plants, 5 wood-treating plants, nd 10 fence plants were in operation in 1965.

Total consumption of roundwood by all priary mills increased about 18 million cubic feet tween surveys in spite of the closing of so any wood-using plants. Pulpwood consumption oubled even though there was one less pulpmill 1965 than in 1954. The number of sawmills in 1954 was reduced by 80 percent in 1965, but consumption of saw logs and bolts at the remaining mills was reduced only 20 percent. The opposite was true of veneer logs and bolts, where the rate of consumption dropped faster than the rate of reduction in number of mills. In summary, the closing of mills meant that timber products had to be transported farther to markets, but it had no direct effect on the total volume of raw material used by the remaining mills.

THE FUTURE

Use of industrial wood in the United States expected to rise about 2.5 percent per year tween 1967 and 1985.[7] The 11.6 billion cubic et consumed nationwide in 1967 will jump to billion cubic feet in 1985 if the assumptions ade prove correct. The rate of increase differs arply by industry. For example, the demand r pulpwood is projected to increase at the rate 3.6 percent annually, demand for plywood and neer logs at 3.1 percent, and demand for saw gs only 0.9 percent.

Pulpwood use nationwide for supplying doestic and export markets is estimated to climb om 71.3 to 142 million cords between 1967 and 85. Most of this increased demand must be et in the North, the Rocky Mountains, and anada. Although the South has been a big pplier of the nation's pulpwood (47 percent of e total in 1967), only about 10 million addional cords are available there, assuming half the present excess volume of growth over timr removals could be used as pulpwood. Northn forests could supply approximately 17 million ditional cords of roundwood mostly in hardood species, assuming half of the present excess lume of growth over removals could be used pulpwood. (The additional volumes could be igher if plant residues, logging residues, and innings are included.)

Michigan's Output of Timber Products Projected to Double in 30 Years

With the growing national consumption of wood and the advantage enjoyed by the North in being able to provide a good share of the added pulpwood demand, the market outlook for Michigan's forest products is bright. A projection of timber products output in Michigan between 1965 and 1995 indicates big increases in the harvest of pulpwood (fig. 15), veneer logs, and miscellaneous industrial products,[8] a small increase in the cut of saw logs, and a big reduction in the cut of fuelwood. The 1995 output of pulpwood is expected to be 70 percent of the total roundwood output, compared with only 53 percent in 1965 (fig. 16).

Despite this projected increase in timber consumption, the level of primary timber-based employment[9] is expected to decline from 19,000 man-years in 1965 to 15,000 man-years in 1995. Only the employment of persons engaged in forest management is expected to rise continually (fig. 17). The trend toward greater mechanization in the woods, and automation in the mill and plant are the big reasons for the projected employment decline. However, the greater productivity that results from improved technology

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[7] *From a recent interim projection by the .S.D.A. Forest Service reported in a speech by . R. Josephson, Director, Division of Forest conomics and Marketing Research, U.S.D.A. orest Service, titled, "Availability of Wood upplies for the Pulp and Paper Industry," ebruary 20, 1968.*

[8] *Miscellaneous industrial products include particleboard bolts, poles, pilings, mine timbers, posts, chemical wood, box bolts, and an assortment of other items.*

[9] *Includes employment in forest management, timber harvesting, and primary manufacturing plants and mills.*

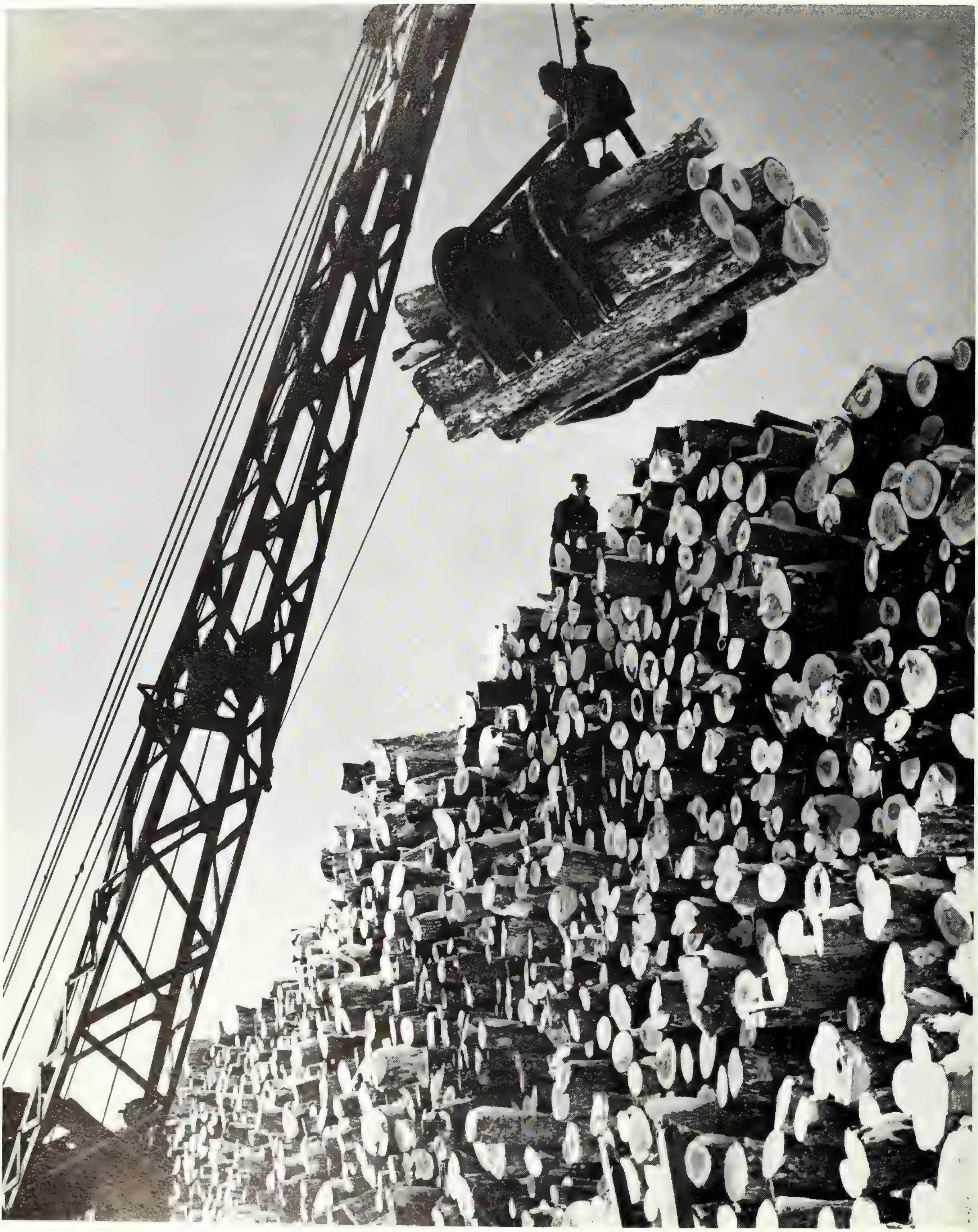
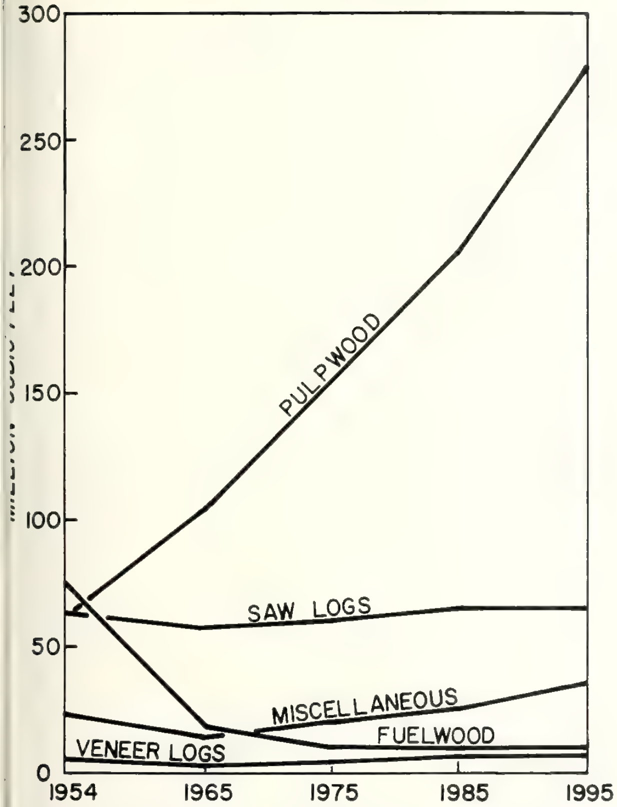
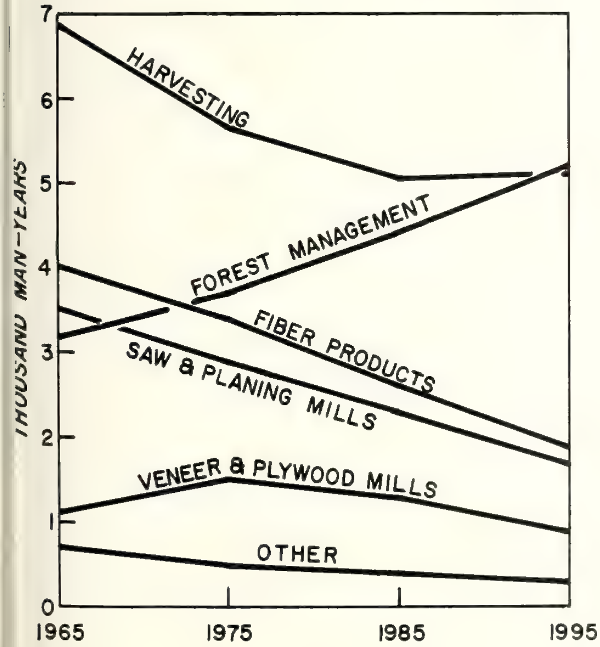


Figure 15.—Hardwood pulpwood being stacked at a Michigan pulp mill. Little used by pulp mills in the past, short-fibered hardwoods are now needed to satisfy the growing demand for pulpwood. The State's output of round pulpwood in 1995 is projected to be 2.7 times higher than in 1965. (Photo courtesy of Michigan Department of Natural Resources.)



igure 16.—Roundwood products output by major product groups in Michigan, 1954 and 1965, and projections for 1975, 1985, and 1995.



igure 17.—Primary timber-based employment in Michigan, 1965, and projected employment in 1975, 1985, and 1995.

will require additional employment in service and related industries not reflected in the above timber-based industry estimates.

Timber-based payrolls are projected to more than double during the same 30-year period that employment is expected to drop by 22 percent. Part of the reason for this apparent contradiction is that the 1995 payroll is not in 1965 constant dollars, therefore, 1995 dollars reflect expected future inflation. However, the highly skilled employees required to run automated mills and complex harvesting equipment will receive larger salaries than the average employee of 1965.

Gap Between Timber Removals and Growth Projected to Narrow in Next 30 Years

What is likely to happen to Michigan's timber resource during the next three decades? If the changes occur that were assumed in the projection of timber products output, it is expected that removals of growing stock will increase from 206 million cubic feet in 1966 to 433 million cubic feet in 1996. This increase in the volume of trees removed will narrow the gap between net growth and timber removals. Net growth in 1965 was 2.8 times greater than removals, and by 1996 it is projected to be only 1.6 times greater than removals. Even after removals equal growth, both may be increased through timber stand improvement, genetic improvement, and fertilization. The surplus of growth over removals in the first decade of the projection period would increase the inventory rapidly – from 15.0 billion cubic feet in 1966 to 18.5 billion cubic feet in 1976. As the growth surplus declines, the growing-stock inventory will level off, and remain constant when net growth and removals are equal. For 1996 the projected inventory of growing stock is 24.4 billion cubic feet.

Softwood growing-stock removals are expected to increase at a slower rate than hardwood removals (fig. 18), largely because of the expected accelerated harvest of hardwoods for pulpwood.

The trend of projected sawtimber removals, growth, and inventory is similar to that of growing stock. Sawtimber removals in 1996 are expected to reach 1.5 billion board feet, almost double the 0.8 billion board feet in 1966. Growth on sawtimber trees will accumulate less rapidly, but should reach 2.4 billion board feet in 1996, 0.4 billion board feet more than in 1966. If the assumed removals and projected growth prove correct, Michigan's burgeoning sawtimber inventory will climb to 66.4 billion board feet in 1996.

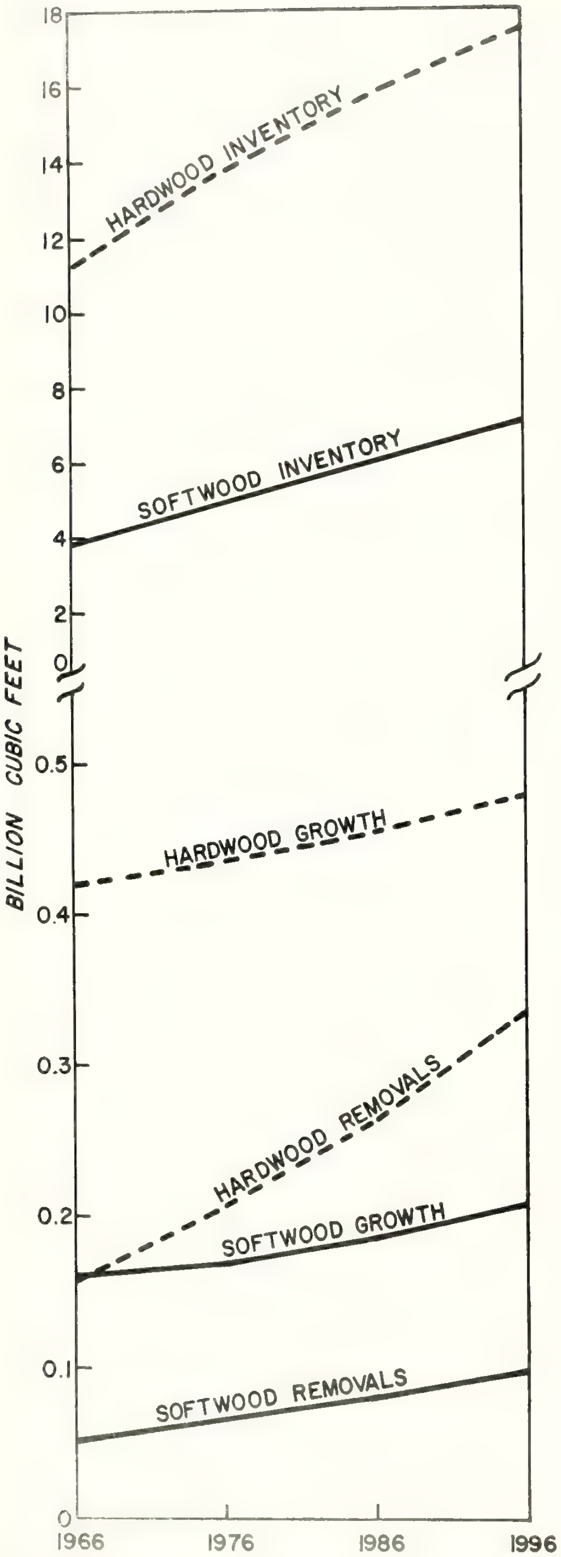


Figure 18.—Growing-stock removals, net growth, and inventory by softwoods and hardwoods, Michigan, 1966, and projections for 1976, 1986, and 1996.

This compares with the 1955 volume of 23. billion board feet and the 1966 figure of 33. billion board feet.

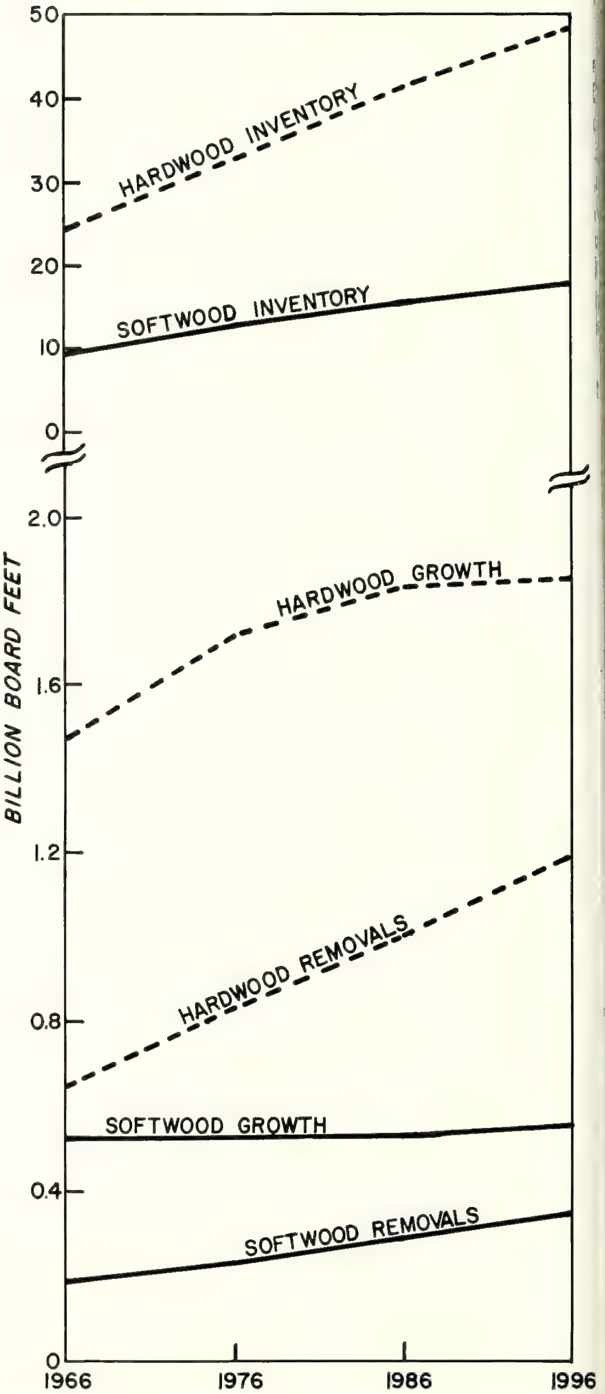


Figure 19.—Sawtimber removals, net growth, and inventory by softwoods and hardwoods, Michigan, 1966, and projections for 1976, 1986, and 1996.

Softwood sawtimber growth is projected to hange little over the 30-year period (fig. 19). On the other hand, hardwood growth is expected o increase sharply and then level off at the end of the projection period.

Projections provide a long-range view that is useful in planning or managing a timber crop. The above projections provide a reasonably ccurate description of the future timber resource if the assumptions on which they were based are orrect. These assumptions, which are detailed in a footnote to table 49 in the Appendix, seem easonable now but may be far off the mark by 996. Therefore, the greatest utility of these projections is in evaluating the timber situation ver the next decade.

There are a number of possible developments that could affect Michigan's future wood requirements and the role of wood in satisfying the needs of an increasing population. One such development is new equipment to permit chipping of whole trees in the woods and mechanical cutting, limbing, bucking, and stacking of pulpwood. Also, the growing importance of outdoor recreation will have an impact on the extent and methods of timber harvesting. Corporate mergers within timber-based industries will bring broader marketing control and perhaps a greater degree of stability to those engaged in providing raw materials to the industry. Opening markets overseas and competition from imports will affect the flow of timber products, but it is impossible now to judge their net effect. These and other possible innovations make the future difficult to predict, but they suggest that the future of Michigan's timber resource will be substantially different from its past.

APPENDIX

Accuracy of Survey

The forest area and timber inventory estimates in this report are based on a carefully designed sample of Michigan's forests. Since neither every acre nor every tree in the State was measured, the reported figures are best estimates. A measure of the reliability of these estimates is given by a sampling error. Following is an example of how sampling error is used.

The estimated volume of growing stock in Michigan in 1966, 15,025.0 million cubic feet, has a sampling error of ± 1.2 percent (180.3 million cubic feet). This means that if there were no errors in procedure, the odds are 2 to 1 that if we repeated the survey in the same way, the new estimate would be between 14,844.7 and 15,205.3 million cubic feet (15,025.0 ± 180.3). Similarly, the odds are 19 to 1 that it would be within ± 360.6 million cubic feet (180.3 x 2) of the present estimate.

Likewise, the sampling error for total area of commercial forest land in Michigan is ± 0.5 percent; sampling error for total sawtimber volume is ± 2.4 percent; and sampling error for total timber removals from growing stock is ± 6. percent.

In addition, the resource statistics are subjec to human errors (mistakes in judgment, recor ing, calculation, and compilation). These erro are minimized through close supervision an careful training of employees and by rechecki all phases of the work.

As area, volume, growth, and cut figures ar broken down by county, forest type, specie ownership, and diameter classes, sampling erro increase – the smaller the unit the higher th sampling error. The following guide may b used in approximating the sampling error f smaller units of measure (fig. 20).

Survey Procedure

Area, Volume, and Growth

In this survey a three-stage sample was use that covered the entire State except for th Ottawa National Forest. A total of 337,08 points on aerial photos were observed, of whic 195,171 were classified as forest land. Of th latter, 43,548 points were stereoclassified as t

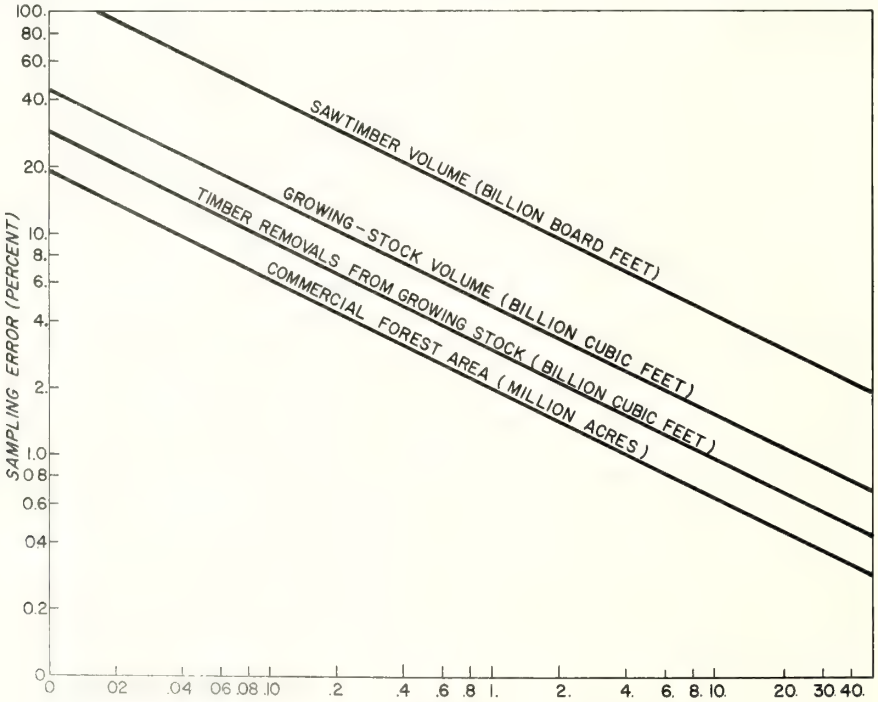


Figure 20.—Sampling errors for commercial forest area, growing-stock volume, sawtimber volume, and timber removals from growing stock, Michigan, 1966.

rest type, stand-size class, and density. A total 3,038 points classed as forest and 3,439 points assed as nonforest were examined on the ground correct for errors in classification and for actual anges in land use since the photos were taken. each of the 2,772 commercial forest land cations, 10 variable-radius plots (37.5 basal ea factor) were established uniformly over a mple acre. One-third of these locations were refully marked for remeasurement during the xt survey.

Growth and mortality information for the rthern three-fourths of the State was obtained rough remeasurement of permanent plots on ate Forests, as well as from all new plots. The ichigan Department of Natural Resources re-easured 4,779 1/5-acre plots to obtain this formation. In the Southern Lower Peninsula, ere there are no State Forests containing per-anent plots, increment borings were taken and rtality information recorded to obtain growth ta.

Statistics on utilization in 1965 were ob-ined from mill surveys, wood utilization stu-es, and a tally of stumps on inventory plots. e Michigan Department of Natural Resources nducted a thorough canvass of resident saw-lls, pulpmills, veneer mills, and other primary od-using plants. The North Central Forest periment Station canvassed the mining indus- and out-of-State sawmills, pulpmills, and ve-er mills to determine their use of timber from ichigan. Fuelwood and fencepost output was sed on U. S. Census of Agriculture and Hous- figures, a canvass of public and industrial nber owners, and estimates of mill residues ed for fuelwood determined from a canvass Michigan primary wood-using plants. Timber t for products was determined by a canvass all public and industrial timber owners.

To develop wood utilization factors used in nverting timber products output to timber novals by products, approximately 1,400 felled es throughout the State were measured.

lowable Cut

Allowable cut is the volume of timber on mmercial forest land that could be cut annually the next 10 years, while improving tree stock- and bringing about a more even distribution age classes. It includes one-tenth of the volume stands that would reach or exceed rotation e during the next 10 years. It also includes nd improvement cuts (partial cuts) in over-ocked stands. Stands selected for harvest cuts cultural operations had to have a yield of at least 3 cords per acre to be included in the allowable cut.

Allowable cut is based on the assumptions that all timber will be available and accessible when needed, and that a ready market will exist for every species, size, and grade of material harvested. Further, it assumes that the proper sequence of cutting is known and will be followed, and that logging practices employed will result in an improved forest. Because there is no way of guaranteeing that these assumptions will be valid over the next 10 years, the allowable cut estimates should be compared with timber removals figures only in a general way.

Definition of Terms[10]

Land-Use Classes

Gross area. – The entire area of land and water as determined by the Bureau of Census, 1960.

Land area. – The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs and estuaries. Canals less than 1/8 mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1960.

Forest land. – Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet in width.

Commercial forest land.—Forest land which is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both accessible and inaccessible areas and both operable and currently inoperable trees.

Noncommercial forest land. – (a) Unproductive – forest land incapable of yielding crops of industrial wood because of adverse site conditions. (b) Productive-reserved — forest land withdrawn from commercial timber use through statute or administrative regulation.

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[10] *These are current standard definitions and are presented even though some of the classes do not occur in this report.*

Nonforest land. — Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land. "Cropland" and "pasture and range" figures were obtained from the Bureau of Census.

Ownership Classes

National Forest. — Federal lands that have been designated by Executive Order or Statute as National Forests or purchase units, and other lands under the administration of the Forest Service.

Bureau of Land Management. — Federal land administered by the Bureau of Land Management.

Indian — Tribal lands held in fee by the Federal Government but administered for Indian tribal groups and Indian trust allotments.

Miscellaneous Federal. — Federal lands other than National Forest, Bureau of Land Management, and Indian lands.

State, county, and municipal. — Lands owned by States, counties, or local public agencies, or lands leased by them for more than 50 years.

Other public. — All public lands other than National Forests.

Forest industry. — Lands owned by companies or individuals operating wood-using plants.

Pulp and paper producer. — A forest owner who manufactures woodpulp and who uses a greater cubic volume of timber from his land for this purpose than for any other primary wood product that he may produce.

Lumber producer. — A forest owner who manufactures lumber and uses a greater cubic volume of timber from his land for this purpose than for any other primary wood product that he may produce.

Farmer-owned. — Lands owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually or, if less than 10 acres, the yield must be at least $250 annually.

Miscellaneous private. — Privately owne lands other than forest-industry or farmer-ownec

Tree Classes

All live trees. — Growing-stock, rough, an rotten trees.

Growing-stock trees. — All live trees of an size except rough and rotten trees.

Desirable trees. — Growing-stock trees havin no serious defects in quality limiting present c prospective use, and of relatively high vigor an containing no pathogens that may result in deat or serious deterioration before rotation age. Thes are trees that would be favored by forest mana gers in silvicultural operations.

Acceptable trees. — Trees meeting the stanc ards for growing stock but not qualifying as de sirable trees.

Sawtimber trees. — Live trees of commercia species containing at least a 12-foot saw lo Softwoods must be at least 9.0 inches in diamete at breast height and hardwoods at least 11. inches.

Poletimber trees. — Live trees of commercia species at least 5.0 inches in diameter at breas height but smaller than sawtimber size, and c good form and vigor.

Saplings. — Live trees of commercial specie 1.0 to 5.0 inches in diameter at breast height an of good form and vigor.

Seedlings. — Live trees of commercial specie less than 1.0 inch in diameter at breast heigh that are expected to survive according to regiona standards. (Examples of seedlings not expecte to survive are those that are diseased or heavil damaged by logging, browsing, or fire.) Onl softwood seedlings over 6 inches and hardwoo seedlings over 1 foot in height are counted.

Rotten trees. — Live trees of commercia species that do not contain a merchantable 12 foot saw log, now or prospectively, because c rot (that is, when more than 50 percent of th cull volume of the tree is rotten).

Rough trees. — Live trees that do not contai at least one merchantable 12-foot saw log, now o prospectively, because of roughness, poor form or noncommercial species.

Short-log trees (rough trees). — Trees tha contain one or more 8- to 11-foot saw logs an which would qualify as sawtimber trees excep for the 12-foot saw log length requirement.

Stocking

The degree of utilization of land by trees a measured in terms of basal area and/or th number of trees required to utilize fully th growth potential of the land. The actual stocking at a point was evaluated against the stocking standard for that specific forest type in square feet of basal area per acre for trees 5.0 inches in diameter at breast height and larger, or its equivalent in numbers of trees per acre for seedlings and saplings. Actual stocking is expressed as a percent of the stocking required to utilize fully the growth potential of the land and is grouped into stocking classes.

Stocking Classes

Well-stocked stands. — Stands 70 percent or more stocked with growing-stock trees.

Medium-stocked stands. — Stands 40 to 69 percent stocked with growing-stock trees.

Lightly stocked stands. — Stands 10 to 39 percent stocked with growing-stock trees.

Stand-Size Classes

Sawtimber stands. — Stands at least 10 per cent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands. — Stands at least 10 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands. — Stands at least 10 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas. — Commercial forest land less than 10 percent stocked with growing-stock trees.

Area-Condition Classes

Excellent. — Areas 70 percent or more stocked with desirable trees.

Good. — Areas 40 to 70 percent stocked with desirable trees and on which less than 30 percent of the area is controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Favorable. — Areas 40 to 70 percent stocked with desirable trees and on which 30 percent or more of the area is controlled by other trees and/or inhibiting vegetation or conditions that will prevent occupancy by desirable trees.

Moderately favorable. — Areas less than 40 percent stocked with desirable trees but with 70 percent or more of the area occupied by growing-stock trees.

Fair. — Areas less than 40 percent stocked with desirable trees but with 40 to 70 percent of the area occupied by growing-stock trees.

Unfavorable. — Areas less than 40 percent stocked with desirable trees and with less than 40 percent of the area occupied by growing-stock trees.

Other Land Classifications

Site index. — An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes. — A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age. — Age of the main stand for both even and uneven-aged stands. Main stand refers to trees of the dominant forest type and stand-size class.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Michigan are:

White-red-jack pine. — Forests in which eastern white pine, red pine, jack pine, or scotch pine, singly or in combination, comprise a plurality of the stocking of live trees. These forests may be subtyped as white pine, red pine, jack pine, or scotch pine depending on which species is most common.

Spruce-fir. — Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. These forests may be subtyped as balsam fir - white spruce, black spruce, northern white-cedar, or tamarack depending on which species is most common.

Oak-hickory. — Forests in which upland oaks or hickories, singly or in combination, comprise a plurality of the stocking. Common associates include jack pine, beech, yellow-poplar, elm, maple, and black walnut

Elm-ash-cottonwood. — Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, and maple. These forests may be subtyped cottonwood when it is the most common species.

Maple-beech-birch. — Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, elm, basswood, and white pine. Locally this type is called "northern hardwoods."

Aspen-birch. — Forests in which quaking or bigtooth aspen, balsam poplar, or paper birch, singly or in combination, comprise a plurality of the stocking. Common associates include maple and balsam fir. These forests may be subtyped paper birch when it is the most common species.

Timber Volume

Volume of growing stock. — The volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet but may be converted into solid-wood cords by dividing by 79.

Volume of sawtimber. — Net volume of the saw-log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion. — That part of the bole of sawtimber trees above the merchantable top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Quality Classes

Log grade. — Classification of logs based on external characteristics as indicators of quality. Hardwood species were graded in accordance with "Hardwood Log Grades for Standard Lumber," issued by the Forest Products Laboratory under the designation D 1737, 1953, and U.S.D.A. Forest Service standards for hardwood tie and timber logs. The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the but log did not meet minimum log-grade standards was graded.

Red pine was graded in accordance with "Interim Southern Pine Log Grades," U.S.D.A. Forest Service, 1953. Eastern white pine was graded in accordance with U.S.D.A. Forest Service "Log Grades for Eastern White Pine." All other softwoods were graded according to "Specifications for Log Grades of Hardwoods and Softwoods," Northern Hemlock and Hardwood Association, 1947. The lowest 16-foot log in softwood trees or a shorter log down to 12 feet if a 16-foot butt log was not present was graded.

Growth

Net annual growth of growing stock. — The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber. — The annual change in volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Mortality of growing stock. — The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber. — The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock. — The volume of sound wood in live sawtimber and poletimber trees harvested annually for forest products, including roundwood products, logging residues, and other removals. Roundwood products are logs, bolts, or other round sections cut from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed by cultural operations such as timber stand improvement work, and by land clearing and changes in land use.

Timber removals from sawtimber. — The net board-foot volume of live sawtimber trees cut for forest products annually, including roundwood products, logging residues, and other removals

Timber products output. — All timber products cut from roundwood, and byproducts of wood-manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills. The annual timber cut includes roundwood products and logging residues but does not include output from non-growing stock or plant byproducts.

Principal Tree Species in Michigan[11]

SOFTWOOD SPECIES

White and red pines:	
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Jack pine	*Pinus banksiana*
Spruce and balsam fir:	
White spruce	*Picea glauca*
Black spruce	*Picea mariana*
Balsam fir	*Abies balsamea*
Eastern hemlock	*Tsuga canadensis*
Other eastern softwoods:	
Tamarack	*Larix laricina*
Northern white-cedar	*Thuja occidentalis*
Other softwoods:	
Scotch pine	*Pinus sylvestris*
Eastern redcedar	*Juniperus virginiana*

HARDWOOD SPECIES

Select white oaks:	
White oak	*Quercus alba*
Bur oak	*Quercus macrocarpa*
Chinkapin oak	*Quercus muehlenbergii*
Swamp white oak	*Quercus bicolor*
Select red oaks:	
Northern red oak	*Quercus rubra*
Other red oaks:	
Black oak	*Quercus velutina*
Pin oak	*Quercus palustris*
Hickory:	
Bitternut hickory	*Carya cordiformis*
Pignut hickory	*Carya glabra*
Shagbark hickory	*Carya ovata*
Yellow birch	*Betula alleghaniensis*
Hard maple:	
Black maple	*Acer nigrum*
Sugar maple	*Acer saccharum*
Soft maple:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
American beech	*Fagus grandifolia*
Ash:	
Black ash	*Fraxinus nigra*
White ash	*Fraxinus americana*
Cottonwood and aspen:	
Balsam poplar	*Populus balsamifera*
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Eastern cottonwood	*Populus deltoides*
American basswood	*Tilia americana*
Yellow-poplar	*Liriodendron tulipifera*
Black walnut	*Juglans nigra*
Other eastern hardwoods:	
Black cherry	*Prunus serotina*
American elm	*Ulmus americana*
Rock elm	*Ulmus thomasii*
Slippery elm	*Ulmus rubra*
Paper birch	*Betula papyrifera*
Other hardwoods:	
Hackberry	*Celtis occidentalis*
American sycamore	*Platanus occidentalis*
Butternut	*Juglalns cinerea*
Red mulberry	*Morus rubra*
Blackgum	*Nyssa sylvatica*
Black willow	*Salix nigra*
Boxelder	*Acer negundo*
Honeylocust	*Gleditsia triancanthos*
Black locust	*Robinia pseudoacacia*
Sassafras	*Sassafras albidum*

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[11] *The common and scientific names are based on "Check List of Native and Naturalized Trees of the United States (Including Alaska)" by Elbert L. Little, Jr., U. S. Dep. Agr., Agr. Handb. 41, 472 p. 1953.*

Tables [12]

Text Tables:

1. Net volume of growing stock on commercial forest land by species group and percentage of total vollume (see page 4)
2. Net volume of sawtimber on commercial forest land by species group and percentage of total volume (see page 4)
3. Volume of growing-stock gross growth, mortality, and net growth for selected species (see page 5)
4. Volume of sawtimber gross growth, mortality, and net growth for selected species (see page 6)
5. Area of commercial forest land by stand-size class in Michigan, 1935, 1955, and 1966 (see page 11)
6. Volume of growing stock and sawtimber underutilized and overutilized by species (see page 13)

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7. Area by land class and Forest Survey Unit
8. Area of commercial forest land, by ownership class and Forest Survey Unit
9. Area of commercial forest land, by stand-size and ownership class, and Forest Survey Unit
10. Area of commercial forest land, by stand-volume and ownership class
11. Area of commercial forest land, by stocking class based on selected stand components
12. Area of commercial forest land, by area-condition and ownership class
13. Area of commercial forest land, by site and ownership class
14. Area of commercial forest land, by forest type and ownership class
15. Area of noncommercial forest land, by forest type
16. Area of land and forest land, by county
17. Area of commercial forest land, by forest type, stand-size class, and Forest Survey Unit
18. Area of commercial forest land, by forest type and stand-age class
19. Area of commercial forest land, by forest type and area-condition class
20. Area of commercial forest land, by forest type and site-index class
21. Area of commercial forest land, by stocking class of growing-stock trees and stand-size class

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22. Number of growing-stock trees on commercial forest land, by species and diameter class
23. Number of growing-stock trees on commercial forest land, by diameter class, softwoods and hardwoods, and Forest Survey Unit
24. Percentage of sawtimber trees on commercial forest land, by butt-log grade and species

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25. Net volume of timber on commercial forest land, by timber class and by softwoods and hardwoods
26. Net volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods
27. Net volume of growing stock on commercial forest land, by species and diameter class
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29. Net volume of growing stock on commercial forest land, by species and Forest Survey Unit
30. Net volume of sawtimber on commercial forest land, by species and Forest Survey Unit
31. Net volume of growing stock and sawtimber on commercial forest land, by county and by softwoods and hardwoods

Growth and Removals:

32. Net annual growth and removals of growing stock and sawtimber on commercial forest land, by species
33. Net annual growth and removals of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods
34. Net annual growth of growing stock on commercial forest land, by species and Forest Survey Unit

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[12] *Tables containing growth, mortality, removals, and forest industry information are dated 1965. Tables containing forest area and timber inventory information are dated 1966 and represent conditions as of January 1, 1966, following changes to the area and inventory estimated to have occurred during calendar year 1965.*

35. Net annual growth of sawtimber on com- iercial forest land, by species and Forest Survey nit

36. Timber removals from growing stock on ommercial forest land, by item and species roup

37. Timber removals from live sawtimber on ommercial forest land, by item and species roup.

38. Timber removals from growing stock on ommercial forest land, by species and Forest urvey Unit

39. Timber removals from live sawtimber on ommercial forest land, by species and Forest urvey Unit

ortality:

40. Mortality of growing stock and saw- mber on commercial forest land, by species

41. Mortality of growing stock and saw- mber on commercial forest land, by ownership ass and by softwoods and hardwoods

42. Mortality of growing stock and sawtim- er on commercial forest land, by cause and by ftwoods and hardwoods

tilization:

43. Output of timber products, by source of aterial and by softwoods and hardwoods

44. Output of roundwood products, by source and by softwoods and hardwoods

45. A comparison of the number of primary wood-using plants operating in 1954 and 1965, by Forest Survey Unit

46. Volume of unused residues at primary manufacturing plants, by industry, type of residue, and by softwoods and hardwoods

47. Value of timber products to producer, by Forest Survey Unit

Allowable Cut:

48. Annual allowable cut of growing stock on commercial forest land, by species and Forest Survey Unit

49. Annual allowable cut of live sawtimber on commercial forest land, by species and Forest Survey Unit

Projections:

50. Removals, net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Michigan, 1966, and projections to 1996

51. Timber products output in Michigan, 1965, and projections to 1995

52. Timber-based employment in Michigan, 1965, and projections to 1995

53. Timber-based payrolls in Michigan, 1965, and projections to 1995

Table 7.—Area by land class and Forest Survey Unit, Michigan, 1966

(In thousands of acres)

Land class	All units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Forest land:					
Commercial	18,900.2	4,169.1	4,920.9	6,994.0	2,816.2
Unproductive	205.0	79.5	77.0	34.5	14.0
Productive-reserved	268.2	32.7	185.4	23.2	26.9
Total	19,373.4	4,281.3	5,183.3	7,051.7	2,857.1
Nonforest land:					
Cropland 1/	6,738.0	166.1	80.4	1,169.4	5,322.1
Pasture and range	1,781.2	94.1	48.1	572.4	1,066.6
Other 2/	8,599.5	471.1	260.0	2,593.9	5,274.5
Total	17,118.7	731.3	388.5	4,335.7	11,663.2
All area 3/	36,492.1	5,012.6	5,571.8	11,387.4	14,520.3

1/ Source: 1964 Census of Agriculture.

2/ Includes marshland and open bog, industrial and urban areas, other nonforest land, and 148,800 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.

3/ Source: United States Bureau of the Census, Land and Water Area of the United States, 1960.

Table 8.—Area of commercial forest land, by ownership class and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

Ownership class	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
National Forest	2,422.8	736.4	837.0	840.4	9.0
Other Federal:					
Bureau of Land Management	8.4	4.1	2.8	1.5	--
Indian	17.4	4.5	12.5	.4	--
Miscellaneous Federal	45.1	38.3	1.0	--	5.8
Total other Federal	70.9	46.9	16.3	1.9	5.8
State Forest	3,635.4	1,085.4	660.1	1,889.9	--
Other State	202.6	5.8	5.5	37.6	153.7
County and municipal	108.7	2.6	71.3	16.4	18.4
Forest industry 1/	2,256.7	784.9	1,367.2	72.8	31.8
Farmer	3,530.4	483.0	330.5	1,045.4	1,671.5
Miscellaneous private	6,672.7	1,024.1	1,633.0	3,089.6	926.0
All ownership	18,900.2	4,169.1	4,920.9	6,994.0	2,816.2

1/ Not including 31.9 thousand acres of farmer-owned and miscellaneous private lands leased to forest industry.

Table 9.—Area of commercial forest land, by stand-size and ownership class, and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

Stand-size class	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber	4,723.2	378.7	906.1	144.1	940.5	2,353.8
Poletimber	8,205.8	1,223.3	1,663.7	134.5	745.9	4,438.4
Sapling and seedling	5,432.8	761.8	987.6	90.0	562.6	3,030.8
Nonstocked areas	538.4	59.0	78.0	13.6	7.7	380.1
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1
EASTERN UPPER PENINSULA						
Sawtimber	1,039.5	137.0	288.6	31.6	304.4	277.9
Poletimber	1,800.4	375.4	456.2	14.2	248.1	706.5
Sapling and seedling	1,291.3	224.0	333.5	5.2	224.7	503.9
Nonstocked areas	37.9	--	7.1	4.3	7.7	18.8
All classes	4,169.1	736.4	1,085.4	55.3	784.9	1,507.1
WESTERN UPPER PENINSULA						
Sawtimber	1,559.5	210.4	277.5	33.5	601.6	436.5
Poletimber	2,157.0	443.2	249.8	40.0	451.2	972.8
Sapling and seedling	1,134.8	147.0	105.9	19.6	314.4	547.9
Nonstocked areas	69.6	36.4	26.9	--	--	6.3
All classes	4,920.9	837.0	660.1	93.1	1,367.2	1,963.5
NORTHERN LOWER PENINSULA						
Sawtimber	1,220.3	30.4	340.0	11.8	5.9	832.2
Poletimber	3,568.6	401.6	957.7	27.4	46.6	2,135.3
Sapling and seedling	2,036.3	386.8	548.2	16.7	20.3	1,064.3
Nonstocked areas	168.8	21.6	44.0	--	--	103.2
All classes	6,994.0	840.4	1,889.9	55.9	72.8	4,135.0
SOUTHERN LOWER PENINSULA						
Sawtimber	903.9	.9	--	67.2	28.6	807.2
Poletimber	679.8	3.1	--	52.9	--	623.8
Sapling and seedling	970.4	4.0	--	48.5	3.2	914.7
Nonstocked areas	262.1	1.0	--	9.3	--	251.8
All classes	2,816.2	9.0	--	177.9	31.8	2,597.5

Table 10.—Area of commercial forest land, by stand-volume[1] and ownership class, Michigan, 1966
(In thousands of acres)

Stand volume per acre (board feet)[2]	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	11,648.9	1,460.3	2,304.9	242.3	1,232.8	6,408.6
1,500 to 5,000	5,092.1	673.6	945.5	99.4	696.0	2,677.6
More than 5,000	2,159.2	288.9	385.0	40.5	327.9	1,116.9
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

[1] Sawtimber trees only.
[2] International 1/4-inch rule.

Table 11.—Area of commercial forest land, by stocking class based on selected stand components, Michigan, 1966
(In thousands of acres)

Stocking percentage	Stocking classified in terms of-- All trees	Growing-stock trees	Desirable trees
100+	5,048.8	2,169.6	11.5
90 - 100	3,019.5	2,173.5	4.7
80 - 90	2,733.1	2,458.6	36.7
70 - 80	2,377.2	2,756.2	107.2
60 - 70	1,759.7	2,514.3	145.4
50 - 60	1,159.6	1,757.9	457.3
40 - 50	959.4	1,487.8	918.7
30 - 40	740.1	1,329.9	1,761.7
20 - 30	552.0	1,028.8	2,844.7
10 - 20	387.8	685.2	4,151.2
Less than 10	163.0	538.4	8,461.1
Total	18,900.2	18,900.2	18,900.2

Table 12.—Area of commercial forest land, by area-condition and ownership class, Michigan, 1966
(In thousands of acres)

Area-condition class	All ownerships	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
Excellent: Fully stocked with desirable trees and not overstocked.	162.7	19.7	61.8	6.5	7.1	67.6
Good: Fully stocked with desirable trees, but overstocked with all live trees.	186.9	13.1	45.8	4.8	28.7	94.5
Favorable: Medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.	1,348.8	114.8	270.4	28.4	132.0	803.2
Moderately favorable: Medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.	8,303.8	1,195.7	1,492.2	156.9	1,336.2	4,122.8
Fair: Poorly stocked with desirable trees, but fully stocked with growing-stock trees.	5,575.2	807.4	1,089.5	114.6	623.1	2,940.6
[illegible] Poorly stocked with desirable trees, and with medium or poor [illegible]	3,322.8	272.1	675.7	71.0	129.6	2,174.4
	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

Table 13.—Area of commercial forest land, by site and ownership class, Michigan, 1966
(In thousands of acres)

Site class (cubic feet of growth per acre per year)	All ownership	National Forest	State Forest	Other public	Forest industry	Farmer and miscellaneous private
120 or more	242.2	25.3	46.1	4.9	21.2	144.7
85 - 120	1,797.0	167.0	334.5	35.2	136.7	1,123.6
50 - 85	5,703.8	542.5	1,128.2	118.6	469.1	3,445.4
Less than 50	11,157.2	1,688.0	2,126.6	223.5	1,629.7	5,489.4
All classes	18,900.2	2,422.8	3,635.4	382.2	2,256.7	10,203.1

Table 14.—Area of commercial forest land, by forest type and ownership class, Michigan, 1966
(In thousands of acres)

Forest type	All ownerships	Public	Private
White-red-jack pine	1,765.7	1,398.4	367.3
Spruce-fir	2,873.5	1,110.2	1,763.3
Oak-hickory	2,405.0	605.9	1,799.1
Elm-ash-cottonwood	1,936.0	283.9	1,652.1
Maple-beech-birch	5,244.5	1,239.4	4,005.1
Aspen-birch	4,675.5	1,802.6	2,872.9
All types	18,900.2	6,440.4	12,459.8

Table 15. —Area of noncommercial forest land, by forest type, Michigan, 1966
(In thousands of acres)

Forest type	All areas	Productive-reserved	Unproductive
White-red-jack pine	31.7	8.2	23.5
Spruce-fir	203.0	74.8	128.2
Oak-hickory	19.0	19.0	--
Elm-ash-cottonwood	48.3	16.5	31.8
Maple-beech-birch	87.6	87.6	--
Aspen-birch	83.6	62.1	21.5
All types	473.2	268.2	205.0

Table 16.—Area of land and forest land, by county, Michigan, 1966

County	All [1/] land	Forest land			Commerical forest as a percent of land area
		All forest	Non-commercial	Commercial	
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Percent
Alcona	433.3	324.1	1.3	322.8	74.5
Alger	584.3	540.6	4.7	535.9	91.7
Allegan	530.6	150.7	.6	150.1	28.3
Alpena	363.5	212.2	1.8	210.4	57.9
Antrim	305.3	186.4	.8	185.6	60.8
Arenac	235.5	106.4	1.0	105.4	44.8
Baraga	578.6	543.3	8.2	535.1	92.5
Barry	351.4	94.4	.8	93.6	26.6
Bay	285.4	48.3	.6	47.7	16.7
Benzie	202.2	124.7	2.7	122.0	60.3
Berrien	371.2	71.0	1.6	69.4	18.7
Branch	323.8	56.6	.2	56.4	17.4
Calhoun	453.8	99.7	.7	99.0	21.8
Cass	312.3	69.7	.3	69.4	22.2
Charlevoix	265.0	162.6	.9	161.7	61.0
Cheboygan	464.0	340.3	3.1	337.2	72.7
Chippewa	1,011.2	805.1	38.6	766.5	75.8
Clare	366.1	230.3	1.3	229.0	62.6
Clinton	365.4	45.0	--	45.0	12.3
Crawford	360.3	313.6	10.0	303.6	84.3
Delta	755.2	638.3	14.4	623.9	82.6
Dickinson	484.5	454.0	6.3	447.7	92.4
Eaton	362.9	55.9	.1	55.8	15.4
Emmet	295.0	189.4	6.7	182.7	61.9
Genesee	411.5	56.2	.2	56.0	13.6
Gladwin	321.9	189.7	2.8	186.9	58.1
Gogebic	711.7	666.4	22.3	644.1	90.5
Grand Traverse	297.0	161.7	.6	161.1	54.2
Gratiot	362.2	49.4	--	49.4	13.6
Hillsdale	384.6	70.3	.3	70.0	18.2
Houghton	659.2	576.9	16.1	560.8	85.1
Huron	526.1	62.7	1.1	61.6	11.7
Ingham	357.8	58.6	.3	58.3	16.3
Ionia	368.0	63.5	.1	63.4	17.2
Iosco	350.1	243.9	1.7	242.2	69.2
Iron	766.1	708.7	12.6	696.1	90.9
Isabella	366.1	97.9	.8	97.1	26.5
Jackson	451.2	96.2	.5	95.7	21.2
Kalamazoo	362.9	79.9	1.4	78.5	21.6
Kalkaska	361.0	271.1	.4	270.7	75.0
Kent	551.7	129.3	.6	128.7	23.3
Keweenaw	348.2	341.2	128.5	212.7	61.1
Lake	366.1	297.1	.2	296.9	81.1
Lapeer	420.5	83.8	3.8	80.0	19.0
Leelanau	223.4	114.2	1.0	113.2	50.7

(Continued on next page)

Table 16 continued

County	All [1/] land	Forest land: All forest	Forest land: Non-commercial	Forest land: Commercial	Commercial forest as a percent of land area
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Percent
Lenawee	482.5	64.8	.9	63.9	13.2
Livingston	365.4	92.5	.7	91.8	25.1
Luce	585.0	543.3	17.1	526.2	89.9
Mackinac	649.0	572.0	10.1	561.9	86.6
Macomb	307.8	46.5	1.5	45.0	14.6
Manistee	357.1	221.3	1.1	220.2	61.7
Marquette	1,178.2	1,108.6	11.5	1,097.1	93.1
Mason	315.5	160.1	1.5	158.6	50.3
Mecosta	360.3	149.6	1.2	148.4	41.2
Menominee	660.5	527.5	14.2	513.3	77.7
Midland	332.8	171.7	1.6	170.1	51.1
Missaukee	361.6	227.4	.3	227.1	62.8
Monroe	359.7	35.1	.1	35.0	9.7
Montcalm	455.7	134.4	.7	133.7	29.3
Montmorency	355.2	287.5	.5	287.0	80.8
Muskegon	322.6	170.0	1.0	169.0	52.4
Newaygo	548.5	311.7	1.5	310.2	56.6
Oakland	561.3	154.6	17.4	137.2	24.4
Oceana	343.0	152.3	2.1	150.2	43.8
Ogemaw	367.4	241.4	1.9	239.5	65.2
Ontonagon	845.3	784.2	56.9	727.3	86.0
Osceola	371.8	176.1	1.4	174.7	47.0
Oscoda	361.6	302.3	1.0	301.3	83.3
Otsego	339.2	251.8	.8	251.0	74.0
Ottawa	361.0	89.1	.7	88.4	24.5
Presque Isle	418.5	290.8	1.6	289.2	69.1
Roscommon	333.4	271.9	2.0	269.9	81.0
Saginaw	519.7	99.0	.3	98.7	19.0
St. Clair	473.6	79.4	.9	78.5	16.6
St. Joseph	325.1	57.7	.5	57.2	17.6
Sanilac	615.0	70.4	.2	70.2	11.4
Schoolcraft	767.4	654.5	13.1	641.4	83.6
Shiawassee	345.6	42.5	--	42.5	12.3
Tuscola	522.2	105.7	.2	105.5	20.2
Van Buren	388.5	100.1	.5	99.6	25.6
Washtenaw	458.2	84.2	1.1	83.1	18.1
Wayne	388.5	38.2	1.6	36.6	9.4
Wexford	360.3	221.9	1.5	220.4	61.2
State total	36,492.1	19,373.4	473.2	18,900.2	51.8

[1/] From U.S. Bureau of the Census, Land and Water Area of the United States, 1966.

Table 17.—Area of commercial forest land, by forest type, stand-size class, and Forest Survey Unit, Michigan, 1966
(In thousands of acres)

ALL UNITS

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
White-red-jack pine:					
Jack pine	896.7	107.7	454.1	323.3	11.6
Red pine	596.5	130.3	148.9	315.6	1.7
White pine	154.3	118.6	9.6	19.7	6.4
Scotch pine	118.2	--	4.3	113.9	--
Spruce-fir:					
Balsam fir-white spruce	1,081.7	141.2	585.3	354.7	.5
Black spruce	428.1	33.8	130.9	256.4	7.0
Northern white-cedar	1,187.7	303.2	535.6	321.7	27.2
Tamarack	176.0	10.9	36.2	115.7	13.2
Oak-hickory	2,405.0	725.7	1,035.1	512.4	131.8
Elm-ash-cottonwood	1,936.0	572.6	733.8	474.7	154.9
Maple-beech-birch	5,244.5	2,181.0	2,149.2	873.0	41.3
Aspen-birch:					
Aspen	4,259.0	345.3	2,145.0	1,638.5	130.2
Paper birch	416.5	52.9	237.8	113.2	12.6
All types	18,900.2	4,723.2	8,205.8	5,432.8	538.4
EASTERN UPPER PENINSULA					
White-red-jack pine:					
Jack pine	276.2	56.7	127.6	91.9	--
Red pine	173.8	53.1	37.7	83.0	--
White pine	22.7	18.8	3.9	--	--
Spruce-fir:					
Balsam fir-white spruce	393.1	33.0	234.4	125.7	--
Black spruce	229.1	15.7	42.4	166.8	4.2
Northern white-cedar	566.8	148.1	235.5	183.2	--
Tamarack	70.4	5.0	14.2	51.2	--
Oak-hickory	19.8	--	19.8	--	--
Elm-ash-cottonwood	338.7	102.1	184.4	41.2	11.0
Maple-beech-birch	1,204.5	543.2	478.3	177.6	5.4
Aspen-birch:					
Aspen	776.2	63.8	354.5	340.6	17.3
Paper birch	97.8	--	67.7	30.1	--
All types	4,169.1	1,039.5	1,800.4	1,291.3	37.9
WESTERN UPPER PENINSULA					
White-red-jack pine:					
Jack pine	136.1	16.1	68.9	42.9	8.2
Red pine	61.1	25.6	4.7	29.1	1.7
White pine	71.0	57.1	5.7	8.1	.1
Spruce-fir:					
Balsam fir-white spruce	479.5	99.5	214.6	164.9	.5
Black spruce	169.6	18.1	75.2	73.5	2.8
Northern white-cedar	277.0	63.9	130.3	61.1	21.7
Tamarack	44.8	--	2.1	40.0	2.7
Oak-hickory	72.6	3.3	58.5	10.8	--
Elm-ash-cottonwood	247.4	91.8	108.9	44.9	1.8
Maple-beech-birch	2,225.0	1,070.1	802.2	351.2	1.5
Aspen-birch:					
Aspen	1,015.8	98.1	613.8	275.3	28.6
Paper birch	121.0	15.9	72.1	33.0	--
All types	4,920.9	1,559.5	2,157.0	1,134.8	69.6

(Continued on next page)

Table 17 continued

NORTHERN LOWER PENINSULA

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
White-red-jack pine:					
Jack pine	472.1	34.9	256.0	177.8	3.4
Red pine	325.1	37.4	89.9	197.8	--
White pine	43.0	36.7	--	--	6.3
Scotch pine	82.0	--	--	82.0	--
Spruce-fir:					
Balsam fir-white spruce	193.0	8.7	136.3	48.0	--
Black spruce	29.4	--	13.3	16.1	--
Northern white-cedar	333.8	91.2	165.2	77.4	--
Tamarack	40.3	--	19.9	16.0	4.4
Oak-hickory	1,296.1	290.1	719.7	242.2	44.1
Elm-ash-cottonwood	630.5	187.5	255.3	161.6	26.1
Maple-beech-birch	1,313.4	327.9	765.1	198.6	21.8
Aspen-birch:					
Aspen	2,061.3	172.8	1,049.9	775.9	62.7
Paper birch	174.0	33.1	98.0	42.9	--
All types	6,994.0	1,220.3	3,568.6	2,036.3	168.8

SOUTHERN LOWER PENINSULA

Forest type	All stands	Saw-timber stands	Pole-timber stands	Sapling and seedling stands	Non-stocked areas
White-red-jack pine:					
Jack pine	12.3	--	1.6	10.7	--
Red pine	36.5	14.2	16.6	5.7	--
White pine	17.6	6.0	--	11.6	--
Scotch pine	36.2	--	4.3	31.9	--
Spruce-fir:					
Balsam fir-white spruce	16.1	--	--	16.1	--
Northern white-cedar	10.1	--	4.6	--	5.5
Tamarack	20.5	5.9	--	8.5	6.1
Oak-hickory	1,016.5	432.3	237.1	259.4	87.7
Elm-ash-cottonwood	719.4	191.2	185.2	227.0	116.0
Maple-beech-birch	501.6	239.8	103.6	145.6	12.6
Aspen-birch:					
Aspen	405.7	10.6	126.8	246.7	21.6
Paper birch	23.7	3.9	--	7.2	12.6
All types	2,816.2	903.9	679.8	970.4	262.1

Table 18.—Area of commercial forest land, by forest type and stand-age class, Michigan, 1966
(In thousands of acres)

Forest type	All ages	Stand-age class (years) 0-19	20-39	40-49	50-59	60-69	70-79	80-89	90-99	100-119	120-139	140+
White-red-jack pine:												
Jack pine	896.7	232.6	402.7	156.2	69.5	29.8	--	5.6	0.3	--	--	--
Red pine	596.5	316.8	193.0	12.8	44.0	18.0	11.0	.9	--	--	--	--
White pine	154.3	45.4	7.2	20.5	10.1	18.1	14.6	9.3	5.3	16.5	3.9	3.4
Scotch pine	118.2	111.7	4.3	2.2	--	--	--	--	--	--	--	--
Spruce-fir:												
Balsam fir-white spruce	1,081.7	319.2	328.6	176.6	115.5	60.5	47.2	.3	16.9	16.9	--	--
Black spruce	428.1	63.9	140.1	39.4	78.4	22.8	56.5	26.4	.4	--	.2	--
Northern white-cedar	1,187.7	107.3	180.7	167.9	194.4	159.9	89.7	97.3	40.2	75.0	65.9	9.4
Tamarack	176.0	48.6	36.8	42.3	31.3	5.5	11.3	.2	--	--	--	--
Oak-hickory	2,405.0	562.2	425.4	320.1	377.6	205.7	171.9	119.0	35.8	145.7	41.6	--
Elm-ash-cottonwood	1,936.0	537.4	442.8	258.3	227.6	106.1	92.7	67.6	48.4	86.3	33.4	35.4
Maple-beech-birch	5,244.5	597.8	1,059.8	754.9	709.1	386.2	344.1	253.9	203.5	409.1	340.0	186.1
Aspen-birch:												
Aspen	4,259.0	1,579.9	1,603.5	630.2	249.9	113.8	60.9	15.3	5.5	--	--	--
Paper birch	416.5	90.9	156.8	85.7	65.7	5.1	.4	8.4	--	3.5	--	--
All types	18,900.2	4,613.7	4,981.7	2,667.1	2,173.1	1,131.5	900.3	604.2	356.3	753.0	485.0	234.3

Table 19.—Area of commercial forest land, by forest type and area-condition class, Michigan, 1966
(In thousands of acres)

Forest type	All area conditions	Excellent	Good	Favorable	Moderately favorable	Fair	Unfavorable
White-red-jack-pine:							
Jack pine	896.7	1.6	1.2	.3	394.8	347.2	151.6
Red pine	596.5	.6	32.2	9.0	211.4	227.4	115.9
White pine	154.3	.6	.5	--	51.4	65.9	35.9
Scotch pine	118.2	--	6.4	7.0	27.7	54.2	22.9
Spruce-fir:							
Balsam fir-white spruce	1,081.7	3.9	47.0	17.0	604.4	326.3	83.1
Black spruce	428.1	1.4	3.2	.8	237.8	136.3	48.6
Northern white-cedar	1,187.7	20.4	.3	42.2	795.6	203.5	125.7
Tamarack	176.0	.3	.4	--	45.3	55.4	74.6
Oak-hickory	2,405.0	.1	17.7	227.2	732.1	786.2	641.7
Elm-ash-cottonwood	1,936.0	1.8	6.1	133.1	698.9	527.4	568.7
Maple-beech-birch	5,244.5	47.2	25.2	554.4	2,915.5	1,310.5	391.7
Aspen-birch:							
Aspen	4,259.0	83.2	38.3	336.0	1,473.7	1,372.6	955.2
Paper birch	416.5	1.6	8.4	21.8	115.2	162.3	107.2
All types	18,900.2	162.7	186.9	1,348.8	8,303.8	5,575.2	3,322.8

Table 20.—Area of commercial forest land, by forest type and site-index class, Michigan, 1966
(In thousands of acres)

Forest type	All sites	Site index class (height in feet at 50 years)								
		10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
White-red-jack pine:										
Jack pine	896.7	--	6.0	33.5	441.3	288.3	122.7	4.9	--	--
Red pine	596.5	--	--	10.6	91.7	190.4	175.7	119.6	8.5	--
White pine	154.3	--	--	8.7	19.7	67.0	53.2	5.7	--	--
Scotch pine	118.2	--	--	--	2.2	31.0	58.3	10.2	16.5	--
Spruce-fir:										
Balsam fir-white spruce	1,081.7	--	.1	105.4	315.7	448.1	159.0	48.4	5.0	--
Black spruce	428.1	--	109.7	206.6	61.8	49.8	.2	--	--	--
Northern white-cedar	1,187.7	51.4	394.4	439.0	180.7	84.3	14.1	23.8	--	--
Tamarack	176.0	--	37.4	56.7	45.4	33.1	3.4	--	--	--
Oak-hickory	2,405.0	--	--	82.4	448.9	672.2	615.1	452.0	123.5	10.9
Elm-ash-cottonwood	1,936.0	--	--	61.0	298.7	517.5	563.6	275.0	179.5	40.7
Maple-beech-birch	5,244.5	--	18.2	101.5	886.1	2,230.1	1,354.3	431.0	159.3	64.0
Aspen-birch:										
Aspen	4,259.0	--	--	65.2	340.6	1,101.0	1,302.0	981.2	380.0	89.0
Paper birch	416.5	--	--	9.1	107.6	124.3	121.9	45.4	8.2	--
All types	18,900.2	51.4	565.8	1,179.7	3,240.4	5,837.1	4,543.5	2,397.2	880.5	204.6

Table 21.—Area of commercial forest land, by stocking class of growing-stock trees and stand-size class, Michigan, 1966
(In thousands of acres)

Stocking percentage	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
70 or more	9,557.9	2,871.0	4,941.3	1,745.6	--
40 to 70	5,760.0	1,310.1	2,345.1	2,104.8	--
10 to 40	3,043.9	542.1	919.4	1,582.4	--
Less than 10	538.4	--	--	--	538.4
All classes	18,900.2	4,723.2	8,205.8	5,432.8	538.4

Table 22.—Number of growing-stock trees on commercial forest land, by species and diameter class, Michigan, 1966
(In thousands of trees)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White and red pines:													
White pine	26,592	7,924	5,046	3,439	3,582	2,442	1,581	1,127	724	297	378	52	--
Red pine	54,721	37,313	8,852	3,091	2,309	1,498	818	474	279	87	--	--	--
Jack pine	109,818	74,445	26,474	6,269	2,014	494	107	15	--	--	--	--	--
Spruce and balsam fir:													
White spruce	41,155	21,136	11,717	4,167	2,236	1,154	467	174	66	31	7	--	--
Black spruce	68,116	49,148	14,917	2,947	727	208	122	47	--	--	--	--	--
Balsam fir	190,342	130,297	43,722	11,787	3,464	797	210	50	15	--	--	--	--
Hemlock	51,032	14,021	10,193	8,812	7,113	4,805	2,853	1,343	923	441	492	36	--
Other softwoods:													
Tamarack	18,878	13,244	4,070	924	381	183	37	39	--	--	--	--	--
Northern white-cedar	236,380	136,985	61,193	21,775	9,225	3,949	1,684	806	378	205	172	8	--
Others	1,132	591	341	84	116	--	--	--	--	--	--	--	--
Total softwoods	798,166	485,104	186,525	63,295	31,167	15,530	7,879	4,075	2,385	1,061	1,049	96	--
Hardwoods:													
Select white oaks	60,740	26,388	15,765	8,460	4,143	2,592	1,538	828	488	167	302	69	--
Select red oaks	85,040	33,639	22,617	13,151	6,959	3,689	2,138	1,043	811	513	418	62	--
Other red oaks	53,280	22,190	13,564	8,122	4,751	2,135	1,422	514	283	205	89	5	--
Hickory	10,447	3,761	2,682	2,214	763	556	257	71	95	40	8	--	--
Yellow birch	53,434	21,581	10,265	7,802	4,896	3,690	2,458	1,203	751	348	362	78	--
Hard maple	306,199	162,734	66,455	32,500	17,903	11,833	7,215	4,266	1,763	785	688	57	--
Soft maple	202,645	109,537	47,888	22,687	10,783	6,528	2,629	1,322	600	306	305	58	2
Beech	36,645	13,578	7,413	4,894	3,726	2,608	2,196	1,239	521	308	159	3	--
Ash	84,831	45,461	23,041	9,052	4,087	1,585	1,029	317	104	67	85	3	--
Cottonwood and aspen:													
Balsam poplar	25,237	9,985	5,458	4,503	2,488	1,387	742	386	177	58	53	--	--
Cottonwood	3,194	337	540	285	871	411	306	225	116	40	55	8	--
Bigtooth aspen	149,758	75,906	42,101	20,313	7,354	2,987	854	125	111	--	--	7	--
Quaking aspen	233,679	116,860	72,458	28,073	10,760	4,158	1,096	189	47	29	9	--	--
Basswood	61,181	25,930	17,722	8,912	4,692	2,293	920	308	218	125	61	--	--
Yellow poplar	449	190	78	46	30	20	44	11	--	8	22	--	--
Black walnut	120	--	--	--	49	35	16	--	10	10	--	--	--
Other hardwoods:													
Black cherry	27,418	14,346	7,308	3,393	1,367	513	309	141	18	19	--	4	--
Elm	87,768	35,666	22,067	13,670	7,758	3,997	1,895	1,283	604	371	380	71	6
Paper birch	122,677	69,743	32,647	12,723	5,133	1,560	712	116	12	25	6	--	--
Others	6,400	2,785	1,469	1,088	440	275	158	69	35	24	57	--	--
Noncommercial species	107	60	37	10	--	--	--	--	--	--	--	--	--
Total hardwoods	1,611,249	790,677	411,575	201,898	98,953	52,852	27,934	13,656	6,764	3,448	3,059	425	8
All species	2,409,415	1,275,781	598,100	265,193	130,120	68,382	35,813	17,731	9,149	4,509	4,108	521	8

Table 2[illegible].—Number of growing-stock trees on commercial forest land, by diameter class, softwoods and hardwoods, and Forest Survey Unit, Michigan, 1966
(In thousands of trees)

ALL UNITS

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods	3,504,469	1,599,726	1,106,577	485,104	186,525	63,295	31,167	15,530	7,879	4,075	2,385	1,061	1,049	96	--
Hardwoods	6,687,338	3,450,331	1,625,758	790,677	411,575	201,898	98,953	52,852	27,934	13,656	6,764	3,448	3,059	425	8
All species	10,191,807	5,050,057	2,732,335	1,275,781	598,100	265,193	130,120	68,382	35,813	17,731	9,149	4,509	4,108	521	8
EASTERN UPPER PENINSULA															
Softwoods	1,489,940	695,960	485,520	193,437	70,997	22,321	11,084	5,314	2,639	1,360	645	415	231	17	--
Hardwoods	1,236,872	626,584	304,468	149,173	78,858	38,925	17,819	9,729	5,797	2,924	1,376	703	429	87	--
All species	2,726,812	1,322,544	789,988	342,610	149,855	61,246	28,903	15,043	8,436	4,284	2,021	1,118	660	104	--
WESTERN UPPER PENINSULA															
Softwoods	914,129	400,754	286,949	119,533	53,874	24,397	13,543	6,926	3,754	1,865	1,318	518	641	57	--
Hardwoods	2,525,054	1,452,193	608,346	242,370	110,100	52,584	26,847	16,492	8,507	3,989	1,783	889	857	91	6
All species	3,439,183	1,852,947	895,295	361,903	163,974	76,981	40,390	23,418	12,261	5,854	3,101	1,407	1,498	148	6
NORTHERN LOWER PENINSULA															
Softwoods	1,026,993	462,534	312,874	165,805	59,031	15,460	5,869	2,859	1,293	637	405	83	134	9	--
Hardwoods	2,191,486	955,740	570,844	329,569	179,180	84,799	39,582	17,144	8,104	3,586	1,673	732	498	35	--
All species	3,218,479	1,418,274	883,718	495,374	238,211	100,259	45,451	20,003	9,397	4,223	2,078	815	632	44	--
SOUTHERN LOWER PENINSULA															
Softwoods	73,407	40,478	21,234	6,329	2,623	1,117	671	431	193	213	17	45	43	13	--
Hardwoods	733,926	415,814	142,100	69,565	43,437	25,590	14,705	9,487	5,526	3,157	1,932	1,124	1,275	212	2
All species	807,333	456,292	163,334	75,894	46,060	26,707	15,376	9,918	5,719	3,370	1,949	1,169	1,318	225	2

Table 24.—Percentage of sawtimber trees on commercial forest land, by butt-log grade and species, Michigan, 1966

(In percent)

Species	Percent of trees by butt-log grade			
	Grade 1	Grade 2	Grade 3	Grade 4[1]
Softwoods:				
White and red pine				
White pine	7	13	50	30
Red pine	2	7	86	5
Jack pine	--	--	100	--
Spruce and balsam fir:				
White spruce	2	6	92	--
Black spruce	--	9	91	--
Balsam fir	--	3	94	3
Hemlock	6	16	74	4
Other softwoods:				
Tamarack	--	--	94	6
Northern white-cedar	--	4	95	1
Others	--	--	-	100
Total softwoods	3	8	82	7
Hardwoods:				
Select white oaks	18	34	42	6
Select red oaks	21	35	40	4
Other red oaks	12	30	43	15
Yellow birch	31	35	33	1
Hard maple	22	37	40	1
Soft maple	17	37	45	1
Beech	27	34	37	2
Ash	17	49	31	3
Cottonwood and aspen:				
Balsam poplar	16	35	43	6
Cottonwood	42	53	5	--
Bigtooth aspen	13	34	52	1
Quaking aspen	6	42	50	2
Basswood	24	37	39	--
Other hardwoods:				
Black cherry	21	26	51	2
Elm	28	41	30	1
Paper birch	13	31	53	3
Others	23	30	47	--
Total hardwoods	21	37	40	2
All species	14	26	56	4

[1] Grade 4 logs for hardwoods correspond to tie and timber logs.

Table 25.—*Net volume of timber on commercial forest land, by timber class and by softwoods and hardwoods, Michigan, 1966*

(In million cubic feet)

Timber class	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	5,586.0	1,579.9	4,006.1
Upper-stem portion	985.7	278.8	706.9
Total sawtimber	6,571.7	1,858.7	4,713.0
Poletimber trees	8,453.3	1,979.7	6,473.6
Total growing stock	15,025.0	3,838.4	11,186.6
Rough trees:			
Short-log trees	250.8	32.5	218.3
Other rough trees	679.0	75.5	603.5
Rotten trees	242.7	30.3	212.4
Salvable dead trees	57.3	19.3	38.0
All classes	16,254.8	3,996.0	12,258.8

Table 26.—*Net volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1966*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1]		
National Forest	1,705.9	619.2	1,086.7	2,742.7	1,078.3	1,664.4
State Forest	2,883.0	832.3	2,050.7	6,457.5	2,110.5	4,347.0
Other public	297.6	71.1	226.5	777.7	240.8	536.9
Forest industry	2,145.9	680.6	1,465.3	6,375.6	2,209.7	4,165.9
Farmer and miscellaneous private	7,992.6	1,635.2	6,357.4	17,509.8	4,062.8	13,447.0
All ownerships	15,025.0	3,838.4	11,186.6	33,863.3	9,702.1	24,161.2

1/ International 1/4-inch rule.

Table 27.–Net volume of growing stock on commercial forest land, by species and diameter class, Michigan, 1966
(In million cubic feet)

Species	All diameters	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White and red pines:													
White pine	388.2	22.5	31.9	35.8	54.6	52.6	49.7	45.6	37.2	18.9	32.3	7.1	--
Red pine	252.0	73.0	37.1	26.5	31.0	28.6	20.6	16.4	14.0	4.8	--	--	--
Jack pine	369.4	159.2	120.7	51.6	26.8	8.1	2.5	.5	--	--	--	--	--
Spruce and balsam fir:													
White spruce	246.0	54.6	66.2	42.3	34.0	22.5	13.7	6.5	3.3	2.0	.9	--	--
Black spruce	271.1	134.9	83.8	30.1	12.3	4.4	3.7	1.9	--	--	--	--	--
Balsam fir	733.5	314.8	235.7	111.1	48.0	15.1	6.6	1.6	.6	--	--	--	--
Hemlock	566.7	32.8	51.1	74.8	90.6	82.2	70.0	46.7	43.3	25.7	44.0	5.5	--
Other softwoods:													
Tamarack	84.0	37.3	26.4	9.2	5.1	3.5	1.1	1.4	--	--	--	--	--
Northern white-cedar	922.3	243.3	251.5	157.2	101.9	63.2	38.0	24.8	16.0	11.2	13.9	1.3	--
Others	5.2	1.4	1.5	.8	1.5	--	--	--	--	--	--	--	--
Total softwoods	3,838.4	1,073.8	905.9	539.4	405.8	280.2	205.9	145.4	114.4	62.6	91.1	13.9	--
Hardwoods:													
Select white oaks	400.5	44.9	63.6	65.8	51.6	48.0	37.6	27.5	19.8	9.2	23.5	9.0	--
Select red oaks	762.3	92.8	133.8	131.8	107.8	79.5	62.7	37.8	38.4	30.6	36.5	10.6	--
Other red oaks	394.0	53.4	69.3	72.4	65.1	44.6	38.3	18.6	14.2	10.9	6.4	.8	--
Hickory	101.5	11.3	17.7	24.4	13.1	14.3	8.4	3.0	5.5	3.2	.6	--	--
Yellow birch	447.8	37.1	45.2	63.4	58.0	63.7	57.9	37.4	31.7	18.8	25.8	8.8	--
Hard maple	2,234.5	431.3	392.5	332.4	274.4	255.5	201.0	155.8	81.9	46.4	56.9	6.4	--
Soft maple	1,222.2	257.7	256.7	210.8	158.8	137.1	71.5	50.5	27.5	17.9	25.1	8.3	.3
Beech	422.3	37.7	44.4	52.2	58.3	58.1	64.0	49.5	25.6	18.9	13.2	.4	--
Ash	559.0	144.3	148.7	101.1	67.1	35.6	30.9	13.1	5.2	4.0	8.6	.4	--
Cottonwood and aspen:													
Balsam poplar	232.2	26.9	32.7	47.1	40.7	29.3	24.7	15.1	8.5	3.3	3.9	--	--
Cottonwood	76.7	1.6	3.5	3.8	17.1	11.2	11.8	11.1	7.1	3.3	5.0	1.2	--
Bigtooth aspen	771.2	190.6	213.8	177.4	100.4	57.5	21.4	4.4	4.8	--	--	.9	--
Quaking aspen	1,485.9	374.1	480.5	314.8	178.0	95.2	30.9	7.8	2.0	1.9	.7	--	--
Basswood	480.1	76.1	116.2	95.4	76.4	51.8	28.7	12.3	10.2	7.7	5.3	--	--
Yellow poplar	7.7	.9	.6	.5	.6	.5	1.4	.5	--	.6	2.1	--	--
Black walnut	3.1	--	--	--	.7	.8	.6	--	.5	.5	--	--	--
Other hardwoods:													
Black cherry	154.0	37.1	39.3	31.3	19.5	10.8	8.3	5.3	.9	1.0	--	.5	--
Elm	751.4	92.2	122.9	134.7	116.0	84.7	53.8	47.7	29.1	22.7	33.4	12.7	1.5
Paper birch	625.0	189.0	186.5	122.2	73.5	30.6	17.1	3.5	.6	1.4	.6	--	--
Others	55.2	6.2	7.1	12.0	6.3	5.2	8.1	2.5	1.4	1.4	5.0	--	--
Total hardwoods	11,186.6	2,105.2	2,375.0	1,993.5	1,483.4	1,114.0	779.1	503.4	314.9	203.7	252.6	60.0	1.8
All species	15,025.0	3,179.0	3,280.9	2,532.9	1,889.2	1,394.2	985.0	648.8	429.3	266.3	343.7	73.9	1.8

Table 28.—Net volume of sawtimber on commercial forest land, by species and diameter class, Michigan, 1966
(In million board feet)[1]

Species	All diameters	Diameter class (inches at breast height)									
		9.0- [2]/ 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39.0+
Softwoods:											
White and red pines:											
White pine	2,120.9	210.6	324.3	314.3	315.6	297.6	238.4	129.5	239.6	51.0	--
Red pine	814.9	134.2	157.0	160.1	125.8	110.6	93.6	33.6	--	--	--
Jack pine	331.7	184.4	98.6	34.9	11.5	2.3	--	--	--	--	--
Spruce and balsam fir:											
White spruce	633.9	196.4	163.7	118.1	76.9	39.8	20.1	12.5	6.4	--	--
Black spruce	266.3	151.9	59.2	23.2	19.9	12.1	--	--	--	--	--
Balsam fir	779.3	464.4	200.9	68.3	33.4	8.8	3.5	--	--	--	--
Hemlock	2,793.8	371.6	476.1	447.9	415.5	290.7	281.1	174.5	296.0	40.4	--
Other softwoods:											
Tamarack	87.3	34.8	23.1	17.5	4.7	7.2	--	--	--	--	--
Northern white-cedar	1,860.3	584.6	402.9	284.3	190.9	138.5	92.7	69.8	86.7	9.9	--
Others	13.7	4.5	9.2	--	--	--	--	--	--	--	--
Total softwoods	9,702.1	2,337.4	1,915.0	1,468.6	1,194.2	907.6	729.4	419.9	628.7	101.3	--
Hardwoods:											
Select white oaks	1,029.0	--	216.0	215.0	175.2	129.1	93.7	44.2	113.4	42.4	--
Select red oaks	2,115.5	--	535.4	423.4	330.5	207.6	198.2	166.2	196.0	58.2	--
Other red oaks	978.7	--	296.4	221.6	194.5	96.0	78.3	54.4	33.3	4.2	--
Hickory	261.2	--	66.7	79.7	49.5	16.8	29.6	16.2	2.7	--	--
Yellow birch	1,473.0	--	217.8	279.9	283.5	195.6	170.0	109.8	161.2	55.2	--
Hard maple	5,830.1	--	1,335.7	1,325.2	1,096.3	903.0	486.4	290.7	350.7	42.1	--
Soft maple	2,382.4	--	690.8	668.5	348.8	263.9	150.9	92.4	127.5	37.9	1.7
Beech	1,571.7	--	280.7	304.0	350.1	290.4	148.6	114.4	82.1	1.4	--
Ash	840.0	--	333.0	174.7	162.2	71.9	27.7	20.3	47.8	2.4	--
Cottonwood and aspen:											
Balsam poplar	658.8	--	185.4	151.5	146.7	86.3	45.9	18.9	24.1	--	--
Cottonwood	366.5	--	86.8	59.4	66.5	61.6	40.0	18.4	27.8	6.0	--
Bigtooth aspen	1,036.7	--	548.0	311.8	118.2	23.9	29.0	--	--	5.8	--
Quaking aspen	1,647.3	--	903.3	506.0	170.3	43.7	10.0	10.4	3.6	--	--
Basswood	1,051.0	--	405.9	284.8	165.9	69.0	55.7	41.4	28.3	--	--
Yellow poplar	29.8	--	3.1	1.2	7.3	2.8	--	3.2	12.2	--	--
Black walnut	10.9	--	1.7	2.5	2.4	--	1.9	2.4	--	--	--
Other hardwoods:											
Black cherry	188.6	--	80.8	40.4	30.8	26.4	4.0	4.0	--	2.2	--
Elm	1,942.5	--	492.3	399.4	273.0	248.6	152.6	120.9	181.6	65.9	8.2
Paper birch	611.1	--	350.2	147.7	83.9	18.4	3.0	4.6	3.3	--	--
Others	136.4	--	27.1	25.0	30.6	12.2	7.6	7.9	26.0	--	--
Total hardwoods	24,161.2	--	7,057.1	5,621.7	4,086.2	2,767.2	1,733.1	1,140.7	1,421.6	323.7	9.9
All species	33,863.3	2,337.4	8,972.1	7,090.3	5,280.4	3,674.8	2,462.5	1,560.6	2,050.3	425.0	9.9

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[1]/ International 1/4-inch rule.

[2]/ Softwoods only.

Table 29.—Net volume of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1966
(In million cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	388.2	119.0	136.7	94.0	38.5
Red pine	252.0	90.6	40.0	105.0	16.4
Jack pine	369.4	119.3	52.0	195.4	2.7
Spruce and balsam fir:					
White spruce	246.0	81.5	130.2	34.3	--
Black spruce	271.1	102.1	130.5	38.5	--
Balsam fir	733.5	246.3	309.8	177.4	--
Hemlock	566.7	158.1	308.2	91.8	8.6
Other softwoods:					
Tamarack	84.0	25.9	18.3	30.8	9.0
Northern white-cedar	922.3	330.5	224.6	360.5	6.7
Others	5.2	--	--	--	5.2
Total softwoods	3,838.4	1,273.3	1,350.3	1,127.7	87.1
Hardwoods:					
Select white oaks	400.5	.8	--	179.7	220.0
Select red oaks	762.3	18.3	87.3	446.3	210.4
Other red oaks	394.0	.8	--	238.6	154.6
Hickory	101.5	--	--	6.4	95.1
Yellow birch	447.8	122.7	276.4	41.8	6.9
Hard maple	2,234.5	522.5	1,105.9	490.6	115.5
Soft maple	1,222.2	284.3	296.7	377.2	264.0
Beech	422.3	208.3	.4	160.5	53.1
Ash	559.0	55.8	102.8	245.7	154.7
Cottonwood and aspen:					
Balsam poplar	232.2	95.1	20.8	110.1	6.2
Cottonwood	76.7	.4	--	31.1	45.2
Bigtooth aspen	771.2	68.2	76.2	562.0	64.8
Quaking aspen	1,485.9	275.4	564.8	567.0	78.7
Basswood	480.1	60.6	109.3	258.9	51.3
Yellow poplar	7.7	--	--	--	7.7
Black walnut	3.1	--	--	--	3.1
Other hardwoods:					
Black cherry	154.0	24.2	31.7	48.8	49.3
Elm	751.4	100.4	128.9	378.1	144.0
Paper birch	625.0	181.6	134.2	291.8	17.4
Others	55.2	2.1	6.7	10.5	35.9
Total hardwoods	11,186.6	2,021.5	2,942.1	4,445.1	1,777.9
All species	15,025.0	3,294.8	4,292.4	5,572.8	1,865.0

Table 30.—Net volume of sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1966
(In million board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	2,120.9	665.4	738.3	494.1	223.1
Red pine	814.9	370.1	186.7	224.5	33.6
Jack pine	331.7	129.8	64.4	136.6	.9
Spruce and balsam fir:					
White spruce	633.9	168.6	386.9	78.4	--
Black spruce	266.3	71.9	173.9	20.5	--
Balsam fir	779.3	200.7	446.2	132.4	--
Hemlock	2,793.8	810.2	1,491.8	431.1	60.7
Other softwoods:					
Tamarack	87.3	34.3	20.7	19.4	12.9
Northern white-cedar	1,860.3	688.4	745.9	420.1	5.9
Others	13.7	--	--	--	13.7
Total softwoods	9,702.1	3,139.4	4,254.8	1,957.1	350.8
Hardwoods:					
Select white oaks	1,029.0	3.7	--	335.6	689.7
Select red oaks	2,115.5	40.7	189.2	1,107.8	777.8
Other red oaks	978.7	1.3	--	511.4	466.0
Hickory	261.2	--	--	32.9	228.3
Yellow birch	1,473.0	488.1	918.4	54.6	11.9
Hard maple	5,830.1	1,525.1	3,036.1	896.2	372.7
Soft maple	2,382.4	490.6	471.2	667.2	753.4
Beech	1,571.7	798.8	--	594.2	178.7
Ash	840.0	47.1	168.9	285.6	338.4
Cottonwood and aspen:					
Balsam poplar	658.8	246.8	36.9	353.4	21.7
Cottonwood	366.5	2.2	--	161.8	202.5
Bigtooth aspen	1,036.7	131.5	164.9	679.2	61.1
Quaking aspen	1,647.3	278.7	594.9	731.6	42.1
Basswood	1,051.0	125.1	199.7	549.1	177.1
Yellow poplar	29.8	--	--	--	29.8
Black walnut	10.9	--	--	--	10.9
Other hardwoods:					
Black cherry	188.6	20.7	24.6	74.3	69.0
Elm	1,942.5	217.2	322.7	1,025.5	377.1
Paper birch	611.1	185.8	157.7	262.3	5.3
Others	136.4	6.8	8.9	29.5	91.2
Total hardwoods	24,161.2	4,610.2	6,294.1	8,352.2	4,904.7
All species	33,863.3	7,749.6	10,548.9	10,309.3	5,255.5

1/ International 1/4-inch rule.

Table 31.—Net volume of growing stock and sawtimber on commercial forest land, by county and by softwoods and hardwoods, Michigan, 1966

County	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1]		
Alcona	269.8	61.1	208.7	454.0	99.8	354.2
Alger	491.2	155.4	335.8	1,295.6	430.6	865.0
Allegan	85.8	5.5	80.3	245.7	23.5	222.2
Alpena	178.7	53.1	125.6	299.9	88.4	211.5
Antrim	145.2	23.9	121.3	284.8	43.5	241.3
Arenac	82.1	15.3	66.8	156.6	25.2	131.4
Baraga	527.0	164.0	363.0	1,439.9	546.0	893.9
Barry	64.1	2.7	61.4	187.7	11.0	176.7
Bay	35.1	6.0	29.1	69.3	11.6	57.7
Benzie	117.6	17.2	100.4	258.2	35.3	222.9
Berrien	48.2	1.9	46.3	144.6	8.3	136.3
Branch	38.3	1.5	36.8	113.3	6.3	107.0
Calhoun	66.6	2.4	64.2	178.8	9.3	169.5
Cass	53.4	2.4	51.0	150.5	10.7	139.8
Charlevoix	165.0	27.3	137.7	330.5	56.0	274.5
Cheboygan	262.8	64.6	198.2	468.1	109.1	359.0
Chippewa	565.2	226.4	338.8	1,283.6	525.3	758.3
Clare	195.8	29.7	166.1	380.1	59.7	320.4
Clinton	33.9	1.3	32.6	108.0	6.9	101.1
Crawford	197.3	49.2	148.1	319.5	64.5	255.0
Delta	457.2	181.9	275.3	973.9	417.7	556.2
Dickinson	371.7	142.2	229.5	873.1	457.9	415.2
Eaton	36.0	2.0	34.0	104.2	10.1	94.1
Emmet	183.8	32.2	151.6	381.5	64.5	317.0
Genesee	41.2	1.4	39.8	118.0	5.3	112.7
Gladwin	134.5	20.5	114.0	251.0	40.8	210.2
Gogebic	538.4	151.9	386.5	1,171.6	406.4	765.2
Grand Traverse	130.3	22.9	107.4	276.8	47.5	229.3
Gratiot	33.6	1.4	32.2	82.6	6.4	76.2
Hillsdale	48.5	1.5	47.0	148.3	7.3	141.0
Houghton	498.2	131.0	367.2	1,237.3	424.5	812.8
Huron	45.6	.9	44.7	109.2	2.8	106.4
Ingham	41.7	1.1	40.6	134.8	6.4	128.4
Ionia	41.1	3.0	38.1	123.8	15.0	108.8
Iosco	186.2	50.0	136.2	325.4	80.4	245.0
Iron	591.3	189.5	401.8	1,358.2	543.9	814.3
Isabella	80.1	11.9	68.2	165.2	24.8	140.4
Jackson	61.7	2.6	59.1	180.0	9.0	171.0
Kalamazoo	45.4	1.9	43.5	127.1	7.4	119.7
Kalkaska	205.8	55.8	150.0	371.5	92.4	279.1
Kent	82.1	4.3	77.8	229.7	18.8	210.9
Keweenaw	211.8	64.0	147.8	615.0	236.2	378.8
Lake	202.4	27.8	174.6	359.8	44.4	315.4
Lapeer	51.4	2.5	48.9	143.6	10.7	132.9
Leelanau	100.1	14.9	85.2	200.8	34.9	165.9

(Continued on next page)

Table 31 (continued)

County	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			Million board feet[1]		
Lenawee	41.3	1.5	39.8	123.1	6.5	116.6
Livingston	58.7	2.6	56.1	170.8	9.6	161.2
Luce	435.1	191.1	244.0	1,100.8	487.5	613.3
Mackinac	442.7	158.7	284.0	974.8	383.8	591.0
Macomb	35.1	1.3	33.8	103.8	5.5	98.3
Manistee	175.3	24.0	151.3	350.7	50.5	300.2
Marquette	939.9	360.8	579.1	2,525.5	1,185.8	1,339.7
Mason	117.1	16.8	100.3	237.0	35.9	201.1
Mecosta	110.6	14.8	95.8	225.3	33.5	191.8
Menominee	409.4	160.0	249.4	930.8	398.6	532.2
Midland	121.0	18.7	102.3	217.8	37.2	180.6
Missaukee	203.8	42.6	161.2	381.7	82.9	298.8
Monroe	23.1	.5	22.6	67.6	1.8	65.8
Montcalm	92.7	5.2	87.5	245.1	18.0	227.1
Montmorency	239.0	57.8	181.2	412.2	92.8	319.4
Muskegon	124.0	7.2	116.8	339.3	24.2	315.1
Newaygo	248.2	37.7	210.5	476.4	71.5	404.9
Oakland	83.7	3.7	80.0	234.3	13.0	221.3
Oceana	117.0	14.3	102.7	255.9	31.4	224.5
Ogemaw	180.0	33.5	146.5	318.5	55.6	262.9
Ontonagon	614.1	147.0	467.1	1,328.3	454.0	874.3
Osceola	138.8	18.9	119.9	278.5	41.3	237.2
Oscoda	226.5	70.1	156.4	365.4	87.9	277.5
Otsego	205.0	44.6	160.4	352.1	79.3	272.8
Ottawa	46.5	5.8	40.7	123.4	12.5	110.9
Presque Isle	238.3	64.2	174.1	415.4	99.1	316.3
Roscommon	203.9	55.5	148.4	342.8	82.4	260.4
Saginaw	70.2	2.8	67.4	190.2	12.7	177.5
St. Clair	52.9	2.9	50.0	147.2	12.8	134.4
St. Joseph	39.7	1.2	38.5	114.1	4.7	109.4
Sanilac	39.6	1.9	37.7	92.4	7.7	84.7
Schoolcraft	494.0	199.7	294.3	1,190.1	495.9	694.2
Shiawassee	30.3	1.4	28.9	95.4	8.1	87.3
Tuscola	66.6	2.7	63.9	153.0	11.2	141.8
Van Buren	58.6	3.1	55.5	167.4	12.3	155.1
Washtenaw	57.2	2.0	55.2	178.7	9.7	169.0
Wayne	26.2	1.0	25.2	79.9	5.3	74.6
Wexford	175.7	30.8	144.9	326.5	53.1	273.4
State total	15,025.0	3,838.4	11,186.6	33,863.3	9,702.1	24,161.2

[1] International 1/4-inch rule.

Table 32.—Net annual growth and removals of growing stock and sawtimber on commercial forest land, by species, Michigan, 1965

Species	Growing stock		Sawtimber	
	Growth	Removals	Growth	Removals
	Thousand cubic feet		Thousand board feet[1]	
Softwoods:				
White and red pines:				
White pine	13,299	2,229	86,540	14,521
Red pine	25,064	2,026	71,050	8,177
Jack pine	21,934	17,526	52,850	46,531
Spruce and balsam fir:				
Spruce	24,125	5,318	90,600	21,417
Balsam fir	30,022	6,492	86,380	23,133
Hemlock	7,912	8,914	52,270	53,252
Other softwoods:				
Tamarack	1,917	562	6,390	2,206
Northern white-cedar	34,937	6,894	72,210	11,306
Others	830	41	3,180	101
Total softwoods	160,040	50,002	521,470	180,644
Hardwoods:				
Select white oaks	14,996	4,088	52,070	18,693
Select red oaks	31,391	11,711	148,760	51,354
Other red oaks	16,901	3,288	68,040	12,666
Hickory	3,501	[2]	11,940	[2]
Yellow birch	7,813	6,421	23,950	38,203
Hard maple	108,187	22,923	326,650	129,077
Soft maple	65,324	8,589	154,660	37,987
Beech	10,359	4,108	55,170	21,834
Ash	20,143	2,782	50,530	11,811
Cottonwood and aspen:				
Balsam poplar	7,502	997	42,610	5,819
Cottonwood	2,811	1,172	16,080	6,797
Aspen	62,338	68,264	288,340	192,653
Basswood	21,199	3,207	90,720	18,510
Yellow poplar	384	[2]	1,250	[2]
Black walnut	108	371	450	2,333
Other hardwoods:				
Black cherry	7,671	[2]	17,860	[2]
Elm	6,770	10,535	40,300	62,420
Paper birch	29,135	4,168	69,240	14,399
Others	2,984	3,837	8,560	18,232
Total hardwoods	419,517	156,461	1,467,180	642,788
All species	579,557	206,463	1,988,650	823,432

[1] International 1/4-inch rule.

[2] Removals included in other hardwoods.

Table 33.—Net annual growth and removals of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1965

GROWING STOCK

Ownership class	Growth			Removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet					
National Forest	85,323	34,961	50,362	24,354	10,181	14,173
State Forest	108,057	33,501	74,556	27,483	8,619	18,864
Other public	12,383	3,451	8,932	1,324	429	895
Forest industry	72,878	20,628	52,250	31,265	9,654	21,611
Farmer and miscellaneous private	300,916	67,499	233,417	122,037	21,119	100,918
All ownerships	579,557	160,040	419,517	206,463	50,002	156,461

SAWTIMBER

Ownership class	Growth			Removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand board feet[1]					
National Forest	169,800	55,170	114,630	81,073	32,045	49,028
State Forest	412,365	126,301	286,064	84,025	26,521	57,504
Other public	42,995	12,399	30,596	4,112	1,307	2,805
Forest industry	294,720	82,030	212,690	141,720	41,668	100,052
Farmer and miscellaneous private	1,068,770	245,570	823,200	512,502	79,103	433,399
All ownerships	1,988,650	521,470	1,467,180	823,432	180,644	642,788

[1] International 1/4-inch rule.

Table 34.—Net annual growth of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	13,299	3,308	4,416	3,762	1,813
Red pine	25,064	4,195	1,614	16,782	2,473
Jack pine	21,934	8,865	3,746	8,591	732
Spruce and balsam fir:					
White spruce	14,185	5,517	7,198	1,470	--
Black spruce	9,940	4,922	4,007	1,011	--
Balsam fir	30,022	11,989	12,747	5,286	--
Hemlock	7,912	1,807	4,074	1,888	143
Other softwoods:					
Tamarack	1,917	682	699	374	162
Northern white-cedar	34,937	14,117	4,303	16,403	114
Others	830	--	--	--	830
Total softwoods	160,040	55,402	42,804	55,567	6,267
Hardwoods:					
Select white oaks	14,996	25	--	6,191	8,780
Select red oaks	31,391	1,445	5,268	17,731	6,947
Other red oaks	16,901	70	--	11,121	5,710
Hickory	3,501	--	--	148	3,353
Yellow birch	7,813	1,244	4,965	1,244	360
Hard maple	108,187	24,060	54,964	25,762	3,401
Soft maple	65,324	13,659	17,483	23,338	10,844
Beech	10,359	5,857	17	2,586	1,899
Ash	20,143	1,663	1,907	8,779	7,794
Cottonwood and aspen:					
Balsam poplar	7,502	2,360	581	4,255	306
Cottonwood	2,811	7	--	695	2,109
Bigtooth aspen	28,137	3,725	3,911	17,441	3,060
Quaking aspen	34,201	5,932	17,072	6,018	5,179
Basswood	21,199	2,930	6,015	10,463	1,791
Yellow poplar	384	--	--	--	384
Black walnut	108	--	--	--	108
Other hardwoods:					
Black cherry	7,671	1,363	1,840	1,632	2,836
Elm	6,770	5,265	6,665	1,999	1/ -7,159
Paper birch	29,135	7,169	5,782	14,977	1,207
Others	2,984	15	587	158	2,224
Total hardwoods	419,517	76,789	127,057	154,538	61,133
All species	579,557	132,191	169,861	210,105	67,400

1/ Mortality exceeded net annual growth.

Table 35.—Net annual growth of sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	86,540	24,910	30,630	25,560	5,440
Red pine	71,050	19,100	7,910	35,950	8,090
Jack pine	52,850	24,640	6,550	21,080	580
Spruce and balsam fir:					
White spruce	68,710	27,040	33,110	8,560	--
Black spruce	21,890	6,050	13,260	2,580	--
Balsam fir	86,380	31,810	31,940	22,630	--
Hemlock	52,270	9,880	22,630	19,190	570
Other softwoods:					
Tamarack	6,390	370	880	3,570	1,570
Northern white-cedar	72,210	26,490	10,800	34,660	260
Others	3,180	--	--	--	3,180
Total softwoods	521,470	170,290	157,710	173,780	19,690
Hardwoods:					
Select white oaks	52,070	140	--	23,760	28,170
Select red oaks	148,760	4,590	17,740	96,910	29,520
Other red oaks	68,040	100	--	45,950	21,990
Hickory	11,940	--	--	510	11,430
Yellow birch	23,950	5,180	14,070	4,210	490
Hard maple	326,650	82,370	163,320	65,380	15,580
Soft maple	154,660	26,680	26,780	62,880	38,320
Beech	55,170	33,800	--	13,930	7,440
Ash	50,530	780	2,780	23,920	23,050
Cottonwood and aspen:					
Balsam poplar	42,610	13,210	3,550	24,800	1,050
Cottonwood	16,080	60	--	5,460	10,560
Bigtooth aspen	112,440	11,470	11,000	80,110	9,860
Quaking aspen	175,900	36,040	69,110	60,780	9,970
Basswood	90,720	14,690	17,320	50,880	7,830
Yellow poplar	1,250	--	--	--	1,250
Black walnut	450	--	--	--	450
Other hardwoods:					
Black cherry	17,860	2,870	2,810	4,300	7,880
Elm	40,300	19,380	20,670	16,880	2/ -16,630
Paper birch	69,240	17,040	9,080	39,740	3,380
Others	8,560	2/ -70	890	960	6,780
Total hardwoods	1,467,180	268,330	359,120	621,360	218,370
All species	1,988,650	438,620	516,830	795,140	238,060

1/ International 1/4-inch rule.

2/ Mortality exceeded net annual growth.

Table 36.—Timber removals from growing stock on commercial forest land, by item and species group, Michigan, 1965

(In thousand cubic feet)

Item	All species	Softwoods: Pine	Softwoods: Other softwoods	Hardwoods: Aspen	Hardwoods: Other hardwoods
Roundwood products:					
Saw logs	54,885	2,334	3,281	6,032	43,238
Veneer logs and bolts	3,061	36	--	49	2,976
Pulpwood	100,912	16,578	15,813	54,908	13,613
Piling	147	2	12	--	133
Poles	128	61	67	--	--
Mine timbers	936	1	770	--	165
Posts	5,432	10	5,301	5	116
Other	5,376	703	130	2,058	2,485
Fuelwood	4,957	5	22	628	4,302
All products	175,834	19,730	25,396	63,680	67,028
Logging residues	15,129	1,571	2,575	3,394	7,589
Other removals	15,500	480	250	1,190	13,580
All removals	206,463	21,781	28,221	68,264	88,197

Table 37.—Timber removals from live sawtimber on commercial forest land, by item and species group, Michigan, 1965

(In thousand board feet)[1]

Item	All species	Softwoods: Pine	Softwoods: Other softwoods	Hardwoods: Aspen	Hardwoods: Other hardwoods
Roundwood products:					
Saw logs	368,472	15,949	22,154	35,409	294,960
Veneer logs and bolts	22,367	256	--	354	21,757
Pulpwood	292,449	44,513	69,401	138,114	40,421
Piling	905	8	63	--	834
Poles	511	234	277	--	--
Mine timbers	4,668	7	3,599	--	1,062
Posts	6,216	12	5,463	28	713
Other	26,533	2,276	419	10,721	13,117
Fuelwood	16,408	26	112	2,072	14,198
All products	738,529	63,281	101,488	186,698	387,062
Logging residues	45,803	4,031	9,237	5,152	27,383
Other removals	39,100	2,018	589	803	35,690
All removals	823,432	69,330	111,314	192,653	450,135

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[1] International 1/4-inch rule.

Table 38.—Timber removals from growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	2,229	554	1,125	194	356
Red pine	2,026	762	217	904	143
Jack pine	17,526	4,506	3,525	9,405	90
Spruce and balsam fir:					
Spruce	5,318	2,292	2,913	113	--
Balsam fir	6,492	3,765	2,489	238	--
Hemlock	8,914	2,084	6,667	86	77
Other softwoods:					
Tamarack	562	218	247	10	87
Northern white-cedar	6,894	4,624	1,142	1,061	67
Others	41	--	--	--	41
Total softwoods	50,002	18,805	18,325	12,011	861
Hardwoods:					
Select white oaks	4,088	2	--	482	3,604
Select red oaks	11,711	73	309	6,001	5,328
Other red oaks	3,288	2	--	979	2,307
Yellow birch	6,421	1,680	4,640	38	63
Hard maple	22,923	4,585	13,259	1,398	3,681
Soft maple	8,589	519	985	2,217	4,868
Beech	4,108	1,705	353	867	1,183
Ash	2,782	87	193	343	2,159
Cottonwood and aspen:					
Balsam poplar	997	857	43	38	59
Cottonwood	1,172	--	--	122	1,050
Aspen	68,264	11,697	18,388	35,410	2,769
Basswood	3,207	188	674	932	1,413
Black walnut	371	--	--	--	371
Other hardwoods:					
Elm	10,535	342	816	2,845	6,532
Paper birch	4,168	925	383	2,696	164
Others	3,837	139	695	527	2,476
Total hardwoods	156,461	22,801	40,738	54,895	38,027
All species	206,463	41,606	59,063	66,906	38,888

Table 39.—Timber removals from live sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1965

(In thousand board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	14,521	3,732	7,595	1,293	1,901
Red pine	8,177	3,109	1,438	3,356	274
Jack pine	46,531	12,400	9,679	24,269	183
Spruce and balsam fir:					
Spruce	21,417	9,217	11,811	384	5
Balsam fir	23,133	13,654	8,592	885	2
Hemlock	53,252	13,083	39,092	573	504
Other softwoods:					
Tamarack	2,206	935	1,112	55	104
Northern white-cedar	11,306	6,895	2,826	1,532	53
Others	101	--	--	--	101
Total softwoods	180,644	63,025	82,145	32,347	3,127
Hardwoods:					
Select white oaks	18,693	20	--	2,764	15,909
Select red oaks	51,354	432	1,936	20,980	28,006
Other red oaks	12,666	5	--	3,976	8,685
Yellow birch	38,203	10,092	27,734	267	110
Hard maple	129,077	27,283	74,601	7,941	19,252
Soft maple	37,987	2,987	5,643	6,932	22,425
Beech	21,834	10,673	--	5,210	5,951
Ash	11,811	483	1,098	2,168	8,062
Cottonwood and aspen:					
Balsam poplar	5,819	5,072	251	279	217
Cottonwood	6,797	--	--	813	5,984
Aspen	192,653	27,787	48,728	110,281	5,857
Basswood	18,510	1,144	4,078	5,385	7,903
Black walnut	2,333	--	--	--	2,333
Other hardwoods:					
Elm	62,420	1,920	4,853	18,207	37,440
Paper birch	14,399	4,886	1,831	7,578	104
Others	18,232	811	6,110	3,435	7,876
Total hardwoods	642,788	93,595	176,863	196,216	176,114
All species	823,432	156,620	259,008	228,563	179,241

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[1] International 1/4-inch rule.

Table 40.—Mortality[1] of growing stock and sawtimber on commercial forest land, by species, Michigan, 1966

Species	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet[2]
Softwoods:		
White and red pines:		
White pine	2,729	10,519
Red pine	452	999
Jack pine	6,211	4,708
Spruce and balsam fir:		
White spruce	4,173	11,902
Black spruce	6,043	4,314
Balsam fir	25,737	27,893
Hemlock	6,291	32,332
Other softwoods:		
Tamarack	2,172	1,258
Northern white-cedar	7,359	22,153
Others	3	--
Total softwoods	61,170	116,078
Hardwoods:		
Select white oaks	3,112	6,245
Select red oaks	3,606	17,739
Other red oaks	1,851	5,427
Hickory	911	5,257
Yellow birch	4,460	13,103
Hard maple	7,255	27,262
Soft maple	6,349	15,662
Beech	3,854	18,719
Ash	8,845	19,960
Cottonwood and aspen:		
Balsam poplar	4,369	9,817
Cottonwood	859	2,336
Bigtooth aspen	22,288	55,915
Quaking aspen	78,640	118,521
Basswood	3,517	15,330
Other hardwoods:		
Black cherry	1,097	996
Elm	23,972	78,646
Paper birch	7,467	8,089
Others	231	565
Total hardwoods	182,683	414,587
All species	243,853	530,665

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[1] Trend level; not for a specific year.

[2] International 1/4-inch rule.

Table 41.—Mortality[1] of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Michigan, 1966

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Million board feet 2/		
National Forest	27,555	9,396	18,159	40,419	11,677	28,742
State Forest	46,760	13,267	33,493	101,104	25,364	75,740
Other public	4,833	1,132	3,701	12,242	2,890	9,352
Forest industry	34,758	10,845	23,913	99,136	26,547	72,589
Farmer and miscellaneous private	129,947	26,530	103,417	282,764	49,600	233,164
All ownerships	243,853	61,170	182,683	535,665	116,078	419,587

1/ Trend level - not for a specific year.
2/ International 1/4-inch rule.

Table 42.—Mortality[1] of growing stock and sawtimber on commercial forest land, by cause and by softwoods and hardwoods, Michigan, 1966

Cause	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet 2/		
Fire	--	--	--	--	--	--
Insects	31,327	3,270	28,057	76,496	--	76,496
Disease	113,784	20,715	93,069	277,380	48,551	228,829
Other	56,482	19,084	37,398	125,668	45,209	80,459
Unknown	42,260	18,101	24,159	56,121	22,318	33,803
All causes	243,853	61,170	182,683	535,665	116,078	419,587

1/ Trend level - not for a specific year.
2/ International 1/4-inch rule.

Table 43.—Output of timber products, by source of material and by softwoods and hardwoods, Michigan, 1965

Products and species group	Standard unit	Total output		Roundwood products		Plant byproducts	
		Number of std. units	Thousand cu. ft.	Number of std. units	Thousand cu. ft.	Number of std. units	Thousand cu. ft.
Saw logs:	M bd. ft.[1]						
Softwood		38,865	5,722	38,865	5,722	--	--
Hardwood		348,600	51,460	348,600	51,460	--	--
Total		387,465	57,182	387,465	57,182	--	--
Veneer logs and bolts:	M bd. ft.						
Softwood		256	36	256	36	--	--
Hardwood		22,111	3,025	22,111	3,025	--	--
Total		22,367	3,061	22,367	3,061	--	--
Pulpwood:	Std. cords[2]						
Softwood		434,095	34,284	428,880	33,872	5,215	412
Hardwood		931,040	73,523	885,255	69,906	45,785	3,617
Total		1,365,135	107,807	1,314,135	103,778	51,000	4,029
Piling:	M linear ft.						
Softwood		34	14	34	14	--	--
Hardwood		173	133	173	133	--	--
Total		207	147	207	147	--	--
Poles:	M pieces						
Softwood		15	128	15	128	--	--
Mine timbers (round):	M cu. ft.						
Softwood		1,057	1,057	1,057	1,057	--	--
Hardwood		165	165	165	165	--	--
Total		1,222	1,222	1,222	1,222	--	--
Posts (round and split):	M pieces						
Softwood		5,691	5,834	5,691	5,834	--	--
Hardwood		79	121	79	121	--	--
Total		5,770	5,955	5,770	5,955	--	--
Other:[3]	M cu. ft.						
Softwood		833	833	833	833	--	--
Hardwood		5,947	5,947	5,947	5,947	--	--
Total		6,780	6,780	6,780	6,780	--	--
Industrial products:	M cu. ft.						
Softwood		47,908	47,908	47,496	47,496	412	412
Hardwood		134,374	134,374	130,757	130,757	3,617	3,617
Total		182,282	182,282	178,253	178,253	4,029	4,029
Fuelwood:	Std. cords						
Softwood		16,900	1,147	2,314	126	14,586	1,021
Hardwood		354,400	24,741	262,300	18,294	92,100	6,447
Total		371,300	25,888	264,614	18,420	106,686	7,468
All products:	M cu. ft.						
Softwood		49,055	49,055	47,622	47,622	1,433	1,433
Hardwood		159,115	159,115	149,051	149,051	10,064	10,064
Total		208,170	208,170	196,673	196,673	11,497	11,497

[1] M (meaning thousand) board feet by International 1/4-inch rule.

[2] Rough-wood basis (includes chips converted to equivalent standard 128-cubic-foot cord).

[3] Includes charcoal wood, excelsior bolts, particleboard bolts, and farm timber.

Table 44.–Output of roundwood products, by source and by softwoods and hardwoods, Michigan, 1965
(In thousand cubic feet)

Products and species group	All sources	Growing-stock trees 1/			Rough and rotten trees 1/	Salvable dead trees 1/	Other sources 2/
		Total	Saw-timber	Pole-timber			
Saw logs:							
Softwood	5,722	5,615	5,587	28	107	--	--
Hardwood	51,460	49,270	49,192	78	--	1,553	637
Total	57,182	54,885	54,779	106	107	1,553	637
Veneer logs and bolts:							
Softwood	36	36	36	--	--	--	--
Hardwood	3,025	3,025	3,025	--	--	--	--
Total	3,061	3,061	3,061	--	--	--	--
Pulpwood:							
Softwood	33,872	32,391	22,167	10,224	123	872	486
Hardwood	69,906	68,521	37,097	31,424	282	316	787
Total	103,778	100,912	59,264	41,648	405	1,188	1,273
Piling:							
Softwood	14	14	14	--	--	--	--
Hardwood	133	133	133	--	--	--	--
Total	147	147	147	--	--	--	--
Poles:							
Softwood	128	128	106	22	--	--	--
Hardwood	--	--	--	--	--	--	--
Total	128	128	106	22	--	--	--
Mine timbers (round):							
Softwood	1,057	771	676	95	17	268	1
Hardwood	165	165	165	--	--	--	--
Total	1,222	936	841	95	17	268	1
Posts (round and split):							
Softwood	5,834	5,311	1,416	3,895	68	--	455
Hardwood	121	121	121	--	--	--	--
Total	5,955	5,432	1,537	3,895	68	--	455
Other 3/							
Softwood	833	833	467	366	--	--	--
Hardwood	5,947	4,543	3,837	706	1,084	--	320
Total	6,780	5,376	4,304	1,072	1,084	--	320
Total industrial products:							
Softwood	47,496	45,099	30,469	14,630	315	1,140	942
Hardwood	130,757	125,778	93,570	32,208	1,366	1,869	1,744
Total	178,253	170,877	124,039	46,838	1,681	3,009	2,686
Fuelwood:							
Softwood	126	27	17	10	5	--	94
Hardwood	18,294	4,930	2,869	2,061	1,037	--	12,327
Total	18,420	4,957	2,886	2,071	1,042	--	12,421
All products:							
Softwood	47,622	45,126	30,486	14,640	320	1,140	1,036
Hardwood	149,051	130,708	96,439	34,269	2,403	1,869	14,071
Total	196,673	175,834	126,925	48,909	2,723	3,009	15,107

1/ On commercial forest land.

2/ Includes trees less than 5.0 inches in diameter, tree tops and limbs from commercial forest areas or material from noncommercial forest land or nonforest land such as fence rows or suburban areas.

3/ Includes charcoal wood, excelsior bolts, particleboard bolts, and farm timbers.

Table 45.—A comparison of the number of primary wood-using plants operating in 1954 and 1965, by Forest Survey Unit, Michigan
(In number of plants)

Kind of plant[1]	All units		Eastern Upper Peninsula		Western Upper Peninsula		Northern Lower Peninsula		Southern Lower Peninsula	
	1954	1965	1954	1965	1954	1965	1954	1965	1954	1965
Sawmills:										
Large [2]	11	15	1	2	10	8	--	1	--	4
Medium [3]	85	107	14	20	35	20	17	32	19	35
Small [4]	1,866	266	314	23	320	13	574	110	658	120
Total	1,962	388	329	45	365	41	591	143	677	159
Veneer mills:										
Face and core	4	4	2	2	1	--	1	1	--	1
Container	19	8	5	1	--	--	3	3	11	4
Total	23	12	7	3	1	--	4	4	11	5
Pulpmills	11	10	4	3	1	2	2	2	4	3
Charcoal plants	2	1	--	--	2	1	--	--	--	--
Misc. plants	102	[5] 26	20	10	15	3	41	12	26	1
Grand total	2,100	437	360	61	384	47	638	161	718	168

[1] Excludes idle mills except for small sawmills in 1954.

[2] Annual lumber output in excess of 5 million board feet.

[3] Annual lumber output from 1 million to 5 million board feet.

[4] Annual lumber output less than 1 million board feet.

[5] Includes 1 particleboard mill, 1 shingle mill, 1 specialty plant, 1 combination post and pole yard and fence plant, 2 wood-turning plants, 5 log cabin manufacturing plants, 5 wood-treating plants, and 10 fence plants.

Table 46.—Volume of unused residues at primary manufacturing plants, by industry, type of residue, and by softwoods and hardwoods, Michigan, 1965

(In thousand cubic feet)

Species and type of residue	All industries	Lumber	Veneer and plywood
Softwoods			
Coarse 1/	703	703	--
Fine 2/	381	381	--
Total	1,084	1,084	--
Hardwoods			
Coarse 1/	5,253	5,219	34
Fine 2/	4,551	4,498	53
Total	9,804	9,717	87
All species			
Coarse 1/	5,956	5,922	34
Fine 2/	4,932	4,879	53
Total	10,888	10,801	87

1/ Includes slabs, edgings, and veneer cores.
2/ Includes sawdust and shavings.

Table 47.—Value of timber products to producer, by Forest Survey Unit, Michigan, 1965 [1]

(In thousand dollars)

Survey Unit	All products	Product		
		Pulpwood	Lumber logs	All others
Eastern Upper Peninsula	11,240	6,080	2,945	2,215
Western Upper Peninsula	16,535	8,445	5,700	2,390
Northern Lower Peninsula	14,850	8,940	4,155	1,755
Southern Lower Peninsula	8,295	270	6,265	1,760
All units	50,920	23,735	19,065	8,120

1/ Value delivered to the mill.

Table 48.—Annual allowable cut of growing stock on commercial forest land, by species and Forest Survey Unit, Michigan, 1966 to 1975

(In thousand cubic feet)

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
Softwoods:					
White and red pines:					
White pine	10,220	3,491	4,065	2,424	240
Red pine	3,746	1,251	683	1,804	8
Jack pine	11,934	3,845	1,288	6,784	17
Spruce and balsam fir:					
White spruce	8,483	3,050	3,972	1,461	--
Black spruce	6,930	3,076	2,839	1,015	--
Balsam fir	32,134	11,130	12,113	8,891	--
Hemlock	16,043	4,670	8,072	2,637	664
Other softwoods:					
Tamarack	1,642	687	425	452	78
Northern white-cedar	36,485	16,053	9,421	10,834	177
Total softwoods	127,617	47,253	42,878	36,302	1,184
Hardwoods:					
Select white oaks	5,518	47	--	1,437	4,034
Select red oaks	12,234	204	2,318	5,632	4,080
Other red oaks	4,750	68	--	1,488	3,194
Hickory	2,545	--	--	110	2,435
Yellow birch	10,081	3,240	6,085	704	52
Hard maple	38,793	11,128	18,543	7,867	1,255
Soft maple	22,572	8,409	7,559	4,434	2,170
Beech	8,308	4,857	8	3,155	288
Ash	9,238	1,357	3,684	3,296	901
Cottonwood and aspen:					
Balsam poplar	10,677	4,695	460	5,476	46
Cottonwood	2,646	9	--	522	2,115
Bigtooth aspen	25,745	3,601	3,251	17,371	1,522
Quaking aspen	57,201	14,222	20,612	21,714	653
Basswood	7,525	1,415	1,997	3,490	623
Yellow poplar	65	--	--	--	65
Black walnut	29	--	--	--	29
Other hardwoods:					
Black cherry	1,986	435	423	480	648
Elm	12,751	2,432	4,009	5,092	1,218
Paper birch	18,938	5,623	5,025	8,094	196
Others	737	34	50	281	372
Total hardwoods	252,339	61,776	74,024	90,643	25,896
All species	379,956	109,029	116,902	126,945	27,080

Table 49.—Annual allowable cut of live sawtimber on commercial forest land, by species and Forest Survey Unit, Michigan, 1966 to 1975

(In thousand board feet)[1]

Species	All Units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Upper Peninsula	Southern Upper Peninsula
Softwoods:					
White and red pines:					
White pine	60,492	21,309	24,056	13,766	1,361
Red pine	11,207	4,763	3,403	3,041	--
Jack pine	13,851	5,912	2,890	5,049	--
Spruce and balsam fir:					
White spruce	22,848	5,884	13,070	3,894	--
Black spruce	8,589	3,561	4,112	916	--
Balsam fir	41,172	10,247	22,557	8,368	--
Hemlock	85,611	24,270	40,249	16,166	4,926
Other softwoods:					
Tamarack	1,677	508	816	294	59
Northern white-cedar	100,537	42,765	38,768	18,805	199
Total softwoods	345,984	119,219	149,921	70,299	6,545
Hardwoods:					
Select white oaks	19,273	226	--	3,230	15,817
Select red oaks	36,313	678	5,367	12,378	17,890
Other red oaks	16,965	112	--	3,422	13,431
Hickory	7,561	--	--	540	7,021
Yellow birch	37,193	13,251	22,824	1,081	37
Hard maple	112,305	32,651	59,046	15,754	4,854
Soft maple	43,914	16,722	13,516	5,219	8,457
Beech	33,631	19,797	--	12,812	1,022
Ash	16,750	698	8,479	4,419	3,154
Cottonwood and aspen:					
Balsam poplar	27,489	15,070	661	11,758	--
Cottonwood	11,729	54	--	2,170	9,505
Bigtooth aspen	45,149	8,877	8,096	25,554	2,622
Quaking aspen	77,530	14,136	26,042	37,091	261
Basswood	17,021	2,888	4,326	7,079	2,728
Yellow poplar	282	--	--	--	282
Black walnut	134	--	--	--	134
Other hardwoods:					
Black cherry	2,630	301	306	754	1,269
Elm	35,666	6,027	14,411	11,281	3,947
Paper birch	20,056	5,579	6,902	7,200	375
Others	2,520	201	63	1,277	979
Total hardwoods	564,111	137,268	170,039	163,019	93,785
All species	910,095	256,487	319,960	233,318	100,330

[1] International 1/4-inch rule.

Table 50.—Removals,[1] net annual growth, and inventory of growing stock and sawtimber on commercial forest land, Michigan, 1966, and projection[2] to 1966

GROWING STOCK

Year	Removals			Growth			Inventory		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
				(Million cubic feet)					
1966	206.5	50.0	156.5	579.5	160.0	419.5	15,025.0	3,838.4	11,186.6
1976	272.0	65.0	207.0	603.0	169.0	434.0	18,549.0	4,908.0	13,641.0
1986	343.0	80.0	263.0	639.0	185.0	454.0	21,684.0	5,953.0	15,731.0
1996	433.0	98.0	335.0	686.0	208.0	478.0	24,429.0	7,028.0	17,401.0
				SAWTIMBER					
				(Million board feet)[3]					
1966	823.4	180.6	642.8	1,988.7	521.5	1,467.2	33,863.3	9,702.1	24,161.2
1976	1,061.0	233.0	828.0	2,242.0	526.0	1,716.0	45,469.0	12,830.0	32,639.0
1986	1,291.0	289.0	1,002.0	2,365.0	530.0	1,835.0	56,744.0	15,500.0	41,244.0
1996	1,546.0	350.0	1,196.0	2,398.0	548.0	1,850.0	66,374.0	17,695.0	48,679.0

[1] Timber removals includes volumes "lost" due to land clearing, flooding, or reclassification of land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) that the area of commercial forest land will decline at a rate of 0.2 percent per year to about 16-1/2 million acres in 1996; (b) that the intensity of forest management practiced will increase slowly, but net growth rate will decline as stands fill in and the wave of ingrowth passes; (c) that wood will maintain its relative position in the national economy but the demand for timber products from Michigan will increase; and (d) that annual production of roundwood will increase until timber removals equal net growth--about 2,040. Further increases may be stimulated by intensive management and improved utilization. Adequate markets for northern white cedar must be developed before growth and removal curves for softwoods will close.

[3] International 1/4-inch rule.

Table 51.—Timber products output in Michigan, 1965, and projections to 1995
(In thousand cubic feet)

Year	Saw logs	Veneer logs	Miscellaneous [1] industrial products	Pulpwood			Fuelwood		
				Total	Roundwood	Plant byproducts	Total	Roundwood	Plant byproducts
1965	57,182	3,061	14,232	107,807	103,778	4,029	25,888	18,420	7,468
1975	60,000	5,500	20,000	162,000	154,000	8,000	15,000	11,000	4,000
1985	65,000	7,500	25,000	222,000	206,000	16,000	13,000	10,000	3,000
1995	65,000	8,000	35,000	293,000	277,000	16,000	14,000	11,000	3,000

[1] Miscellaneous industrial products include particleboard bolts, poles, piling, mine timbers, posts, chemical wood, and box bolts.

Table 52.—Timber-based employment [1] in Michigan, 1965, and projections to 1995

(In number of man-years of employment) [2]

Year	Total	Forest management	Timber harvesting	Primary manufacture of timber products				
				Total	Sawmills and planing mills 3/	Veneer and plywood mills 3/	Pulp, paper, and allied products mills 4/	Other
1965	19,350	3,200	5/ 6,850	9,300	3,500	1,100	4,000	700
1975	17,660	3,700	5,660	8,300	2,900	1,500	3,400	500
1985	16,050	4,400	5,050	6,600	2,300	1,300	2,600	400
1995	15,130	5,200	5,130	4,800	1,700	900	1,900	300

1/ Includes employment in forest management, timber harvesting and primary manufacturing plants and mills.

2/ A man-year is defined in this report as one man employed for 250 8-hour days.

3/ Sawmills, veneer mills, planing mills, and plywood mills attached to veneer mills (U.S. Census Bureau Standard Industrial Classification (SIC) codes 242, 2,432, and 2,443).

4/ Includes plants manufacturing pulp primarily from wood, and paper mills attached to pulpmills.

5/ Based on an assumption of 115 cubic feet of production per 8-hour man-day from stump to mill.

Table 53.—Timber-based payrolls [1] in Michigan, 1965, and projections to 1995

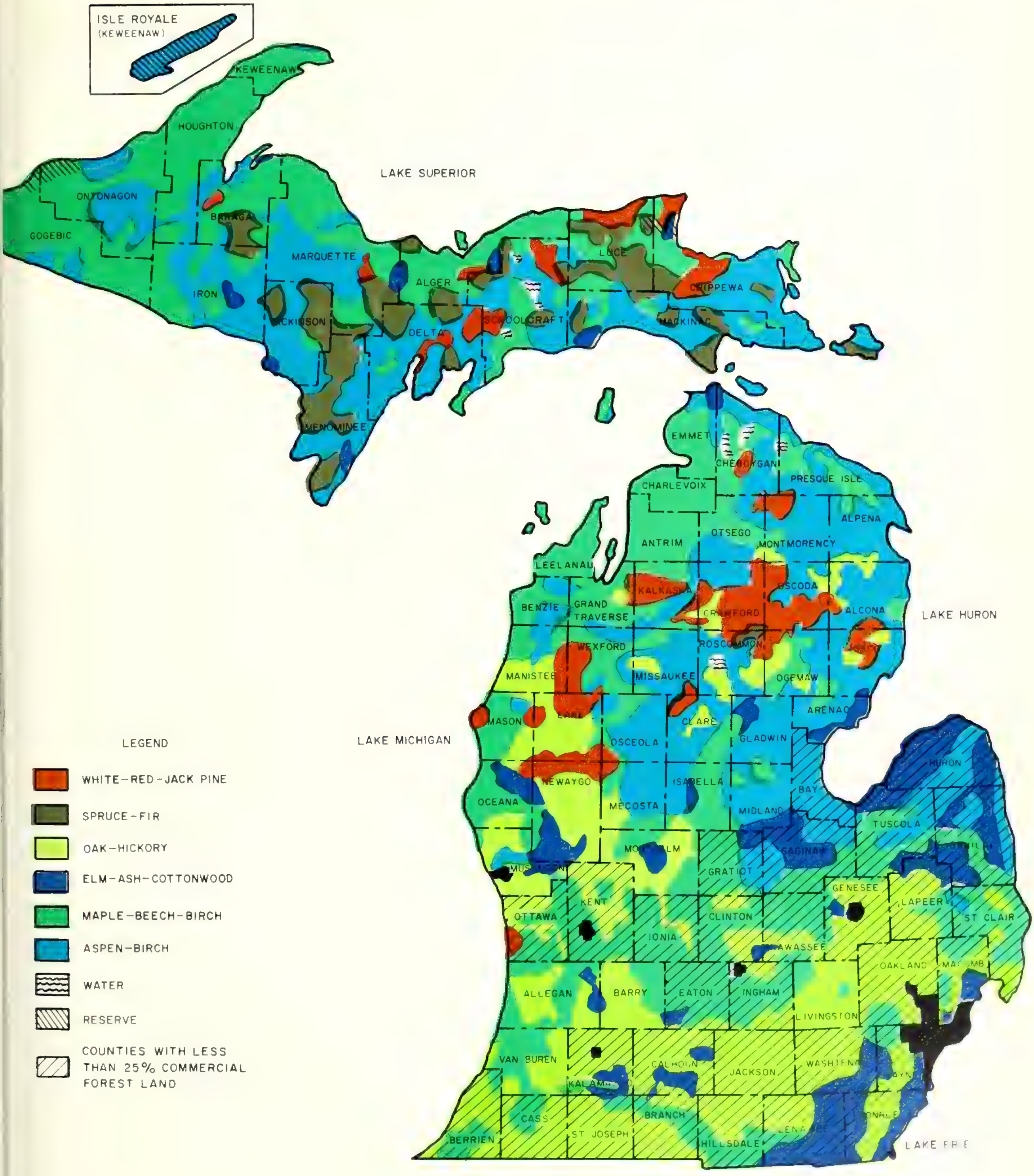
(In thousand dollars)

Year	Total	Forest management	Timber harvesting	Primary manufacture of timber products				
				Total	Sawmills and planing mills 2/	Veneer and plywood mills 2/	Pulp, paper, and allied products mills 3/	Other
1965	95,200	19,200	25,200	50,800	14,100	5,800	27,100	3,800
1975	128,000	25,900	35,600	66,500	15,700	11,000	35,300	4,500
1985	162,700	37,400	47,700	77,600	16,700	13,900	41,900	5,100
1995	206,800	52,000	71,100	83,700	16,600	13,600	47,800	5,700

1/ Includes payrolls of persons engaged in forest management, timber harvesting, and primary manufacture of timber products.

2/ Sawmills, veneer mills, planing mills, and plywood mills attached to veneer mills (U.S. Census Bureau Standard Industrial Classification (SIC) codes 242, 2,432, and 2,443).

3/ Includes plants manufacturing pulp primarily from wood, and paper mills attached to pulpmills.



MAJOR FOREST TYPES—MICHIGAN

(1966)

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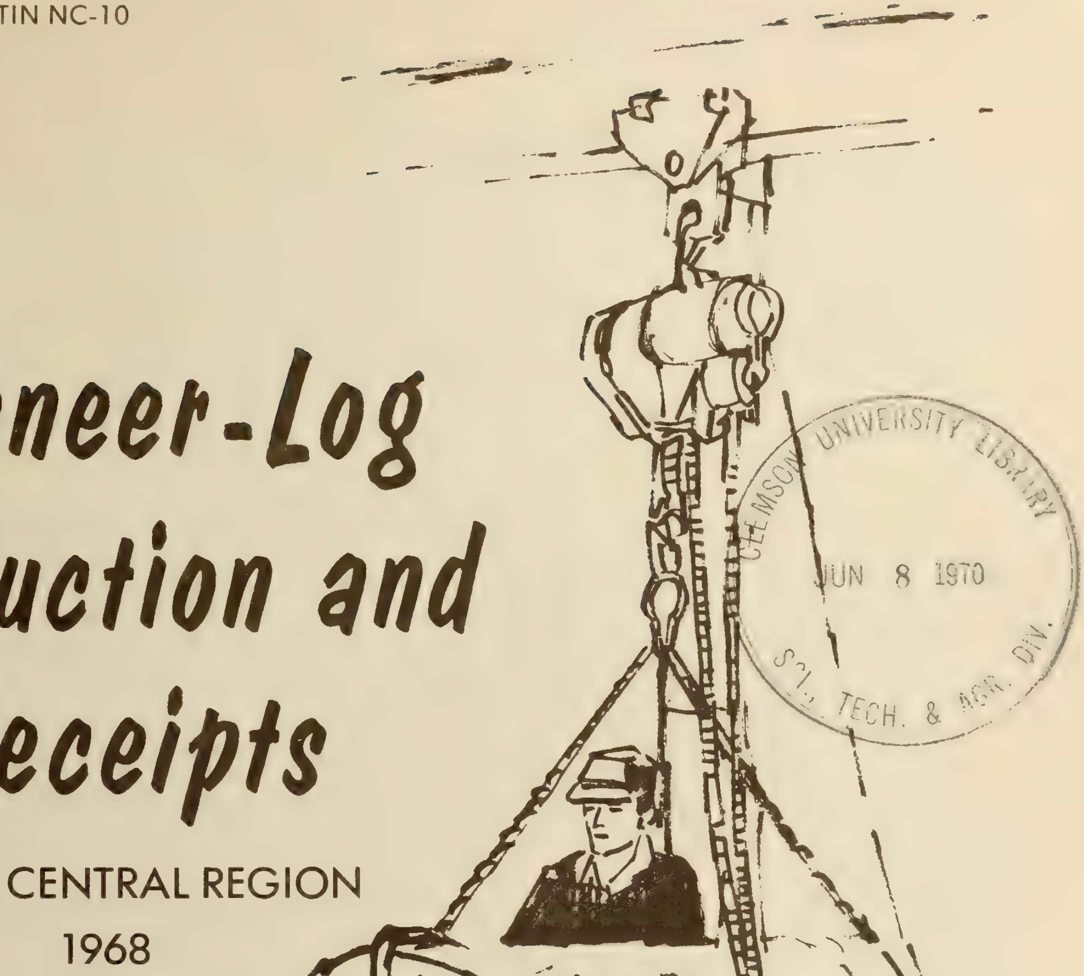
Veneer-Log Production and Receipts

NORTH CENTRAL REGION
1968



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Thomas P. Ginnaty, Jr.

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

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Veneer-Log Production and Receipts, North Central Region, 1968

Thomas P. Ginnaty, Jr.

This report of 1968 veneer-log production[1] and receipts in the North Central Region is divided into two sections – Lake States (Minnesota, Wisconsin, and Michigan) and Central States (Indiana, Illinois, Iowa, and Missouri) – because the species grown and used in each area are different. In the Lake States hard maple, elm, basswood, red oak, and yellow birch dominate while in the Central States the hickories, the oaks, and walnut are more common.

Cooperation by most of the 42 standard and 29 container veneer mills in the North Central Region made this report possible (fig. 1, table 1). All but two mills reported their 1968 veneer-log receipts by species and State of origin. Receipts were estimated for the nonreporting mills. This paper does not include data on exports except those to Canada.

LAKE STATES

Production

Loggers in the Lake States harvested 45.5 million board feet of veneer logs in 1968, only 89 percent of that produced in 1966 (table 2). Thus the trend continues downward (fig. 2), although it has been more gradual since 1958. Hard maple continues to be the leading species cut, with yellow birch, red oak, and elm following in order of volume. Most of the volume harvested (40.6 million board feet) was used by mills cutting commercial, utility, and face veneers for doors, furniture, wall panels, specialty plywood, and similar items. The rest was used in the manufacture of boxes, baskets, and other containers. An additional 2,000 cords of heading stock were used by the container industry.

Wisconsin produced 21.0 million board feet of veneer logs. Red oak, hard maple, and elm accounted for 30, 19, and 15 percent, respectively. Wisconsin mills used nine-tenths of the veneer logs produced within the State and two-thirds of the total volume produced in the Lake States.

Michigan harvested 19.3 million board feet of veneer logs. Of the total, 32 percent was yellow birch and 28 percent was hard maple. Only 43 percent of the veneer logs produced was retained in Michigan while 42 percent was shipped to Wisconsin and 15 percent to other States. Michigan exported 67 and 43 percent of its yellow birch and hard maple logs, respectively, to Wisconsin.

Minnesota, while only harvesting 5.2 million board feet of veneer logs, shipped 68 percent of it to Wisconsin mills. Nine percent was retained and processed within the State. Three percent went to Michigan and the remainder was shipped to other States. Major species cut were red oak and elm.

The Lake States exported 5.8 million board feet of veneer logs in 1968 of which nine-tenths was shipped to Central States mills. The dominant species exported were walnut (1.7 million board feet or all the walnut produced) and hard maple (1.6 million board feet).

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[1] *Production is the volume of veneer logs cut from a specific area; receipts are the volume of veneer logs received by mills in a specific area regardless of the geographic source.*

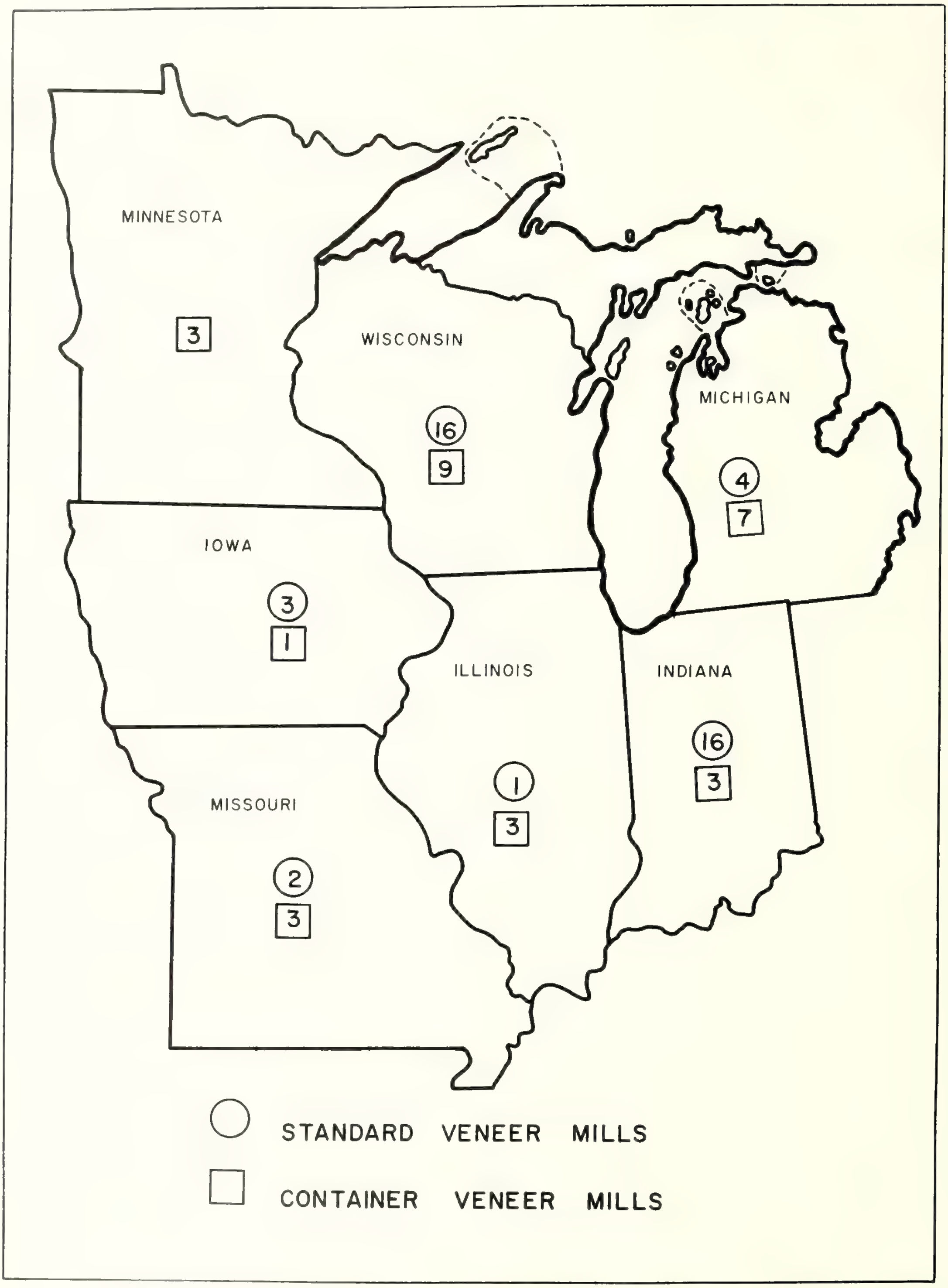


Figure 1. – Distribution of active veneer mills in the North Central States by State and type of mill, 1968.

Table 1. – *Active Veneer Mills in the North Central States by State and type of mill, 1968*

Type of mill	Number	Name of mill	Location
		MINNESOTA	
Standard	None		
Container	1	Bren Berry Box Mfg. Co.	Hopkins
	2	Elk River Box Co.	Elk River
	3	Wahkon Veneer Mills	Wahkon
		WISCONSIN	
Standard	1	Birchwood Lumber & Veneer Co.	Birchwood
	2	Birchwood Mfg. Co.	Rice Lake
	3	Calumet & Hecla, Inc.	Goodman
	4	Calumet & Hecla, Inc.	Mellen
	5	Eggers Plywood Co.	Two Rivers
	6	General Plywood Corp.	Antigo
	7	Gillette Veneer & Plywood Co.	Gillett
	8	Hatley Veneer Co., Inc.	Hatley
	9	Larson Plywood Co., Inc.	Sheboygan
	10	Linwood, Inc.	Gillett
	11	Marion Plywood Corp.	Marion
	12	Northern Hardwood Veneer, Inc.	Butternut
	13	U.S. Plywood Corp.	Algoma
	14	Weber Veneer & Plywood Co.	Shawano
	15	Weyerhaeuser Co.	Marshfield
	16	Wisconsin Timber & Land Co.	Mattoon
Container	1	Brunette Box & Veneer Co.	Rice Lake
	2	Cooley Mfg. Co.	West Bend
	3	Dufeck Mfg. Co.	Denmark
	4	Ebner Box Factory	Cameron
	5	Konz Container Co.	Howard Grove
	6	Millersville Box Co.	Sheboygan
	7	Seymour Woodenware Co.	Seymour
	8	Standard Container Co.	Edgar
	9	Wauzeka Box Co.	Wauzeka
		MICHIGAN	
Standard	1	Birdseye Veneer & Plywood Co.	Escanaba
	2	Manthei Bros.	Petoskey
	3	Plyvoma Veneer Co.	Nashville
	4	Soo Veneer Co.	Sault Ste. Marie
Container	1	A. C. Hensel Mfg. Co.	Augusta
	2	American Made Veneer	Kalkaska
	3	Andersen Container Corp.	Stevensville
	4	Anthony & Co.	Escanaba
	5	Fruit Growers Package Co.	Paw Paw
	6	Riverside Package Co.	Riverside
	7	Wilkinshaw Package Co.	Shelby
		IOWA	
Standard	1	Manchester Industries, Inc.	Manchester
	2	R. S. Bacon Veneer Co.	Dubuque
	3	Spencer Hardwood Lumber Co.	Spencer
Container	1	Burlington Basket Co.	Burlington
		MISSOURI	
Standard	1	Enterprise Veneer Corp.	Pleasant Hill
	2	Missouri Valley Walnut Co.	St. Joseph
Container	1	Betz Tipton Veneer Co.	Caruthersville
	2	Crumbliss Wood Products	Neosho
	3	Neosho Box & Wood Products	Neosho
		ILLINOIS	
Standard	1	Swords Veneer & Lumber Co.	Rock Island
Container	1	Cobden Box & Basket Co.	Cobden
	2	Dongola Veneer Co., Inc.	Dongola
	3	Main Brothers Box & Lbr. Co.	Karnak
		INDIANA	
Standard	1	Amos-Thompson Corp.	Edinburg
	2	B. L. Curry & Sons	New Albany
	3	Central Veneer, Inc.	Indianapolis
	4	Chester B. Stem, Inc.	New Albany
	5	Curry Miller Veneers, Inc.	Indianapolis
	6	David R. Webb Co.	Edinburg
	7	Evansville Veneer Co.	Evansville
	8	Hill Brothers Veneer Co., Inc.	Edinburg
	9	Hoosier Veneer Co., Inc.	Indianapolis
	10	Indiana Veneer, Inc.	Indianapolis
	11	Jasper Veneer Mills	Jasper
	12	Mitchell Industries	Greensburg
	13	National Veneer & Lumber Co.	Seymour
	14	Pierson-Holowell Co., Inc.	Lawrenceburg
	15	Roberts & Strack Veneer Co.	Clarksville
	16	Theising Veneer Co., Inc.	Mooresville
Container	1	Farrel Box Co., Inc.	Decker
	2	New Albany Box & Basket Co., Inc.	New Albany
	3	W. C. Redmon Sons, Inc.	Peru

Table 2. — *Production and imports of veneer logs, Lake States, 1968*
(Thousand board feet, International ¼-inch rule)

Species and destination	Production (Quantity of veneer logs cut in each State)				Imports			Lake States receipts1/
	Minnesota	Wisconsin	Michigan	Region total	Other States	Canada	Total imports	
Aspen								
Minnesota	13	--	--	13	--	--	--	13
Wisconsin	2	381	47	430	--	--	--	430
Michigan	--	--	173	173	--	--	--	173
Total	15	381	220	616	--	—	--	616
Ash2/								
Minnesota	110	--	--	110	--	--	--	110
Wisconsin	22	453	44	519	27	--	27	546
Michigan	--	--	328	328	24	--	24	352
Outside Lake States	--	8	11	19	--	--	--	--
Total	132	461	383	976	51	--	51	1,008
Basswood								
Minnesota	92	--	--	92	--	--	--	92
Wisconsin	723	2,039	256	3,018	312	--	312	3,330
Michigan	--	56	435	491	--	--	--	491
Outside Lake States	--	13	23	36	--	--	--	--
Total	815	2,108	714	3,637	312	—	312	3,913
Beech								
Wisconsin	--	39	79	118	--	--	--	118
Michigan	--	--	374	374	--	--	--	374
Total	--	39	453	492	—	--	--	492
White birch								
Minnesota	27	--	--	27	--	--	--	27
Wisconsin	116	34	28	178	--	1,916	1,916	2,094
Michigan	173	--	1,475	1,648	--	242	242	1,890
Total	316	34	1,503	1,853	--	2,158	2,158	4,011
Yellow birch								
Minnesota	3	--	--	3	--	--	--	3
Wisconsin	309	1,751	4,129	6,189	--	1,824	1,824	8,013
Michigan	--	89	1,929	2,018	--	168	168	2,186
Outside Lake States	--	23	91	114	--	—	--	--
Total	312	1,863	6,149	8,324	—	1,992	1,992	10,202
Butternut								
Minnesota	3	--	--	3	--	--	--	3
Wisconsin	1	11	--	12	--	--	--	12
Outside Lake States	44	384	1	429	--	--	--	--
Total	48	395	1	444	—	--	--	15
Black cherry								
Wisconsin	--	44	21	65	--	--	--	65
Michigan	--	10	151	161	12	--	12	173
Outside Lake States	16	19	31	66	--	--	--	--
Total	16	73	203	292	12	--	12	238
Cottonwood								
Minnesota	103	--	--	103	—	--	—	103
Wisconsin	699	200	--	899	593	--	593	1,492
Michigan	--	--	439	439	58	--	58	497
Total	802	200	439	1,441	651	--	651	2,092

(Continued on next page)

Table 2 continued

Species and destination	Production (Quantity of veneer logs cut in each State)				Imports			Lake States receipts[1/]
	Minnesota	Wisconsin	Michigan	Region total	Other States	Canada	Total imports	
Elm								
Minnesota	32	--	--	32	--	--	--	[illegible]
Wisconsin	710	2,972	558	4,240	370	--	370	4,610
Michigan	--	16	573	589	--	--	--	589
Outside Lake States	182	235	81	498	--	--	--	--
Total	924	3,223	1,212	5,359	370	--	370	5,231
Hickory								
Michigan	--	--	172	172	182	--	182	354
Outside Lake States	--	--	21	21	--	--	--	--
Total	--	--	193	193	182	--	182	354
Hard maple								
Minnesota	27	--	--	27	--	--	--	27
Wisconsin	160	3,731	2,291	6,182	398	772	1,170	7,352
Michigan	--	66	1,505	1,571	--	--	--	1,571
Outside Lake States	--	98	1,540	1,638	--	--	--	--
Total	187	3,895	5,336	9,418	398	772	1,170	8,950
Soft maple								
Minnesota	72	--	--	72	--	--	--	72
Wisconsin	104	784	72	960	76	--	76	1,036
Michigan	--	--	183	183	--	--	--	183
Outside Lake States	--	15	--	15	--	--	--	--
Total	176	799	255	1,230	76	--	76	1,291
Red oak								
Wisconsin	631	6,154	326	7,111	868	8	876	7,987
Michigan	--	92	300	392	--	--	--	392
Outside Lake States	451	1	224	676	--	--	--	--
Total	1,082	6,247	850	8,179	868	8	876	8,379
White oak								
Wisconsin	41	124	--	165	1	--	1	166
Michigan	--	3	--	3	--	--	--	3
Outside Lake States	--	--	309	309	--	--	--	--
Total	41	127	309	477	1	--	1	169
Walnut								
Michigan	--	--	--	--	7	--	7	7
Outside Lake States	301	815	585	1,701	--	--	--	--
Total	301	815	585	1,701	7	--	7	7
Misc. species								
Wisconsin	--	136	150	286	34	--	34	320
Michigan	--	--	338	338	--	--	--	338
Outside Lake States	--	241	40	281	--	--	--	--
Total	--	377	528	905	34	--	34	658
All species								
Minnesota	482	--	--	482	--	--	--	482
Wisconsin	3,518	18,853	8,001	30,372	2,679	4,520	7,199	37,571
Michigan	173	332	8,375	8,880	283	410	693	9,573
Outside Lake States	994	1,852	2,957	5,803	--	--	--	--
Total	5,167	21,037	19,333	45,537	2,962	4,930	7,892	47,626

[1/] Production minus exports plus imports.

[2/] Veneer logs shipped to mills outside the Lake States.

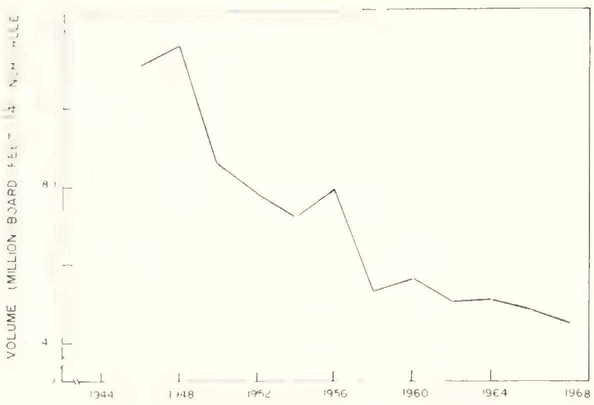


Figure 2. – Lake States veneer-log production, 1946-1968.

Mill Receipts

Lake States mills received 47.6 million board feet of veneer logs in 1968, a decline of 7.8 million board feet since 1966. Although most species declined, the major losses occurred in basswood, hard maple, and red oak. Reasons for the decline given by veneer mill operators were a desire to lower inventories, a shortage of quality veneer logs, reduced demand for furniture veneers produced in the region, and some finished veneers or veneer products were cheaper to import from other regions than to manufacture.

Basswood, long a favorite for veneer core stock, is being replaced by aspen and cottonwood. Demand for hard maple and red oak veneer logs dropped because furniture styles changed to those requiring more pecan and white oak.

Of the 47.6 million board feet received at the mills, 39.7 million board feet came from the region, 4.9 million board feet from Canada, and the remainder from other States. Of the total imported from Canada white and yellow birch were predominant. Cottonwood and red oak were the principal species from States outside the region.

Wisconsin receipts were 37.6 million board feet, predominately yellow birch, red oak, and hard maple. Half the volume came from Wisconsin, while Michigan, Minnesota and Canada supplied 21, 9, and 19 percent respectively. The remainder was imported from other States, mainly Iowa.

(F-501919)

Processing sliced walnut veneer.

Michigan mill receipts were 9.6 million board feet. Nearly 90 percent of this volume was produced in the State. The largest volumes received were yellow birch (23 percent), white birch (20 percent, and hard maple (16 percent).

Minnesota container mills, the only type of veneer mill in the State (fig. 1), received 0.4 million board feet of veneer logs. All the logs were produced within the State and the predominant species were cottonwood and ash.

CENTRAL STATES

Production

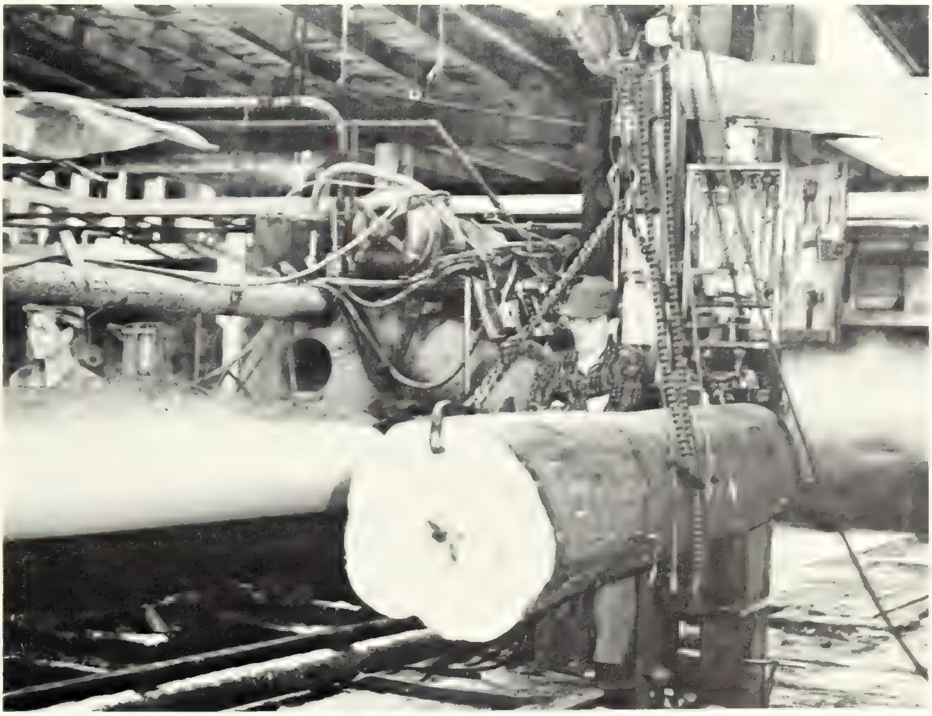
Loggers in the Central States produced 37.0 million board feet of veneer logs (table 3). There were sharp increases over 1966 in hickory, white oak, and walnut – species used for furniture veneer. Walnut, the major species produced in all the Central States, accounted for 44 percent of the total. Of the remainder, cottonwood, white oak, and hickory accounted for almost 30 percent. Walnut and hickory were the largest exports.

Indiana processed 87 percent of its own logs and 56 percent of all the veneer logs produced in the Central States. Illinois, Iowa, and Missouri exported most of their logs to other Central States.

Receipts

Log receipts at Central States mills amounted to 48.8 million board feet, slightly higher than in 1966. The receipts of hickory and white oak more than doubled. This resulted from the shift to furniture styles using these species. Walnut, while accounting for 38 percent of receipts, increased only slightly since 1966.

Almost four-tenths of the Central States log receipts were imported. Of this almost seven-tenths came from Wisconsin, Michigan, Ohio, Kentucky, and Kansas. Walnut, hickory, white oak, and cottonwood were the major species imported.



(F-501920)
Oak log being readied for processing on a rotary veneer rig.

Table 3. – *Production and imports of veneer logs, Central States, 1968*
(Thousand board feet, International ¼-inch rule)

Species	Destination	Production					Imports			Central States receipts1/
		Indiana	Illinois	Iowa	Missouri	Region total	Other States	Canada	Total imports	
Ash	Indiana	398	--	--	--	398	242	--	242	640
	Other Central States2/	--	13	84	18	115	58	--	58	173
	Outside Central States	12	--	26	--	38	--	--	--	--
	Total	410	13	110	18	551	300	--	300	813
Basswood	Indiana	7	--	--	--	7	23	--	23	30
	Other Central States	--	--	488	--	488	13	—	13	501
	Outside Central States	—	27	270	2	299	--	--	--	--
	Total	7	27	758	2	794	36	--	36	531
Black cherry	Indiana	111	12	14	--	137	534	--	534	671
	Other Central States	-	2	31	--	33	23	--	23	56
	Total	111	14	45	--	170	557	--	557	727
Butternut	Indiana	4	--	61	--	65	396	--	396	461
	Other Central States	--	2	38	1	41	32	--	32	73
	Total	4	2	99	1	106	428	--	428	534
Cottonwood	Indiana	999	154	--	--	1,153	103	--	103	1,256
	Other Central States	186	1,721	--	545	2,452	1,964	--	1,964	4,416
	Outside Central States	58	--	411	38	507	--	--	--	--
	Total	1,243	1,875	411	583	4,112	2,067	--	2,067	5,672
Elm	Indiana	36	--	24	--	60	400	--	400	460
	Other Central States	--	35	254	--	289	213	--	213	502
	Outside Central States	--	--	363	2	365	--	--	--	--
	Total	36	35	641	2	714	613	--	613	962
Gum	Indiana	513	110	--	--	623	186	--	186	809
	Other Central States	—	228	--	22	250	--	--	--	250
	Outside Central States		--	--	3	3	--	--	--	--
	Total	513	338	--	25	876	186	--	186	1,059
Hickory	Indiana	522	467	-	556	1,545	2,689	--	2,689	4,234
	Other Central States	--	55	32	345	432	260	--	260	692
	Outside Central States	6	421	-	618	1,045	--	--	--	--
	Total	528	943	32	1,519	3,022	2,949	--	2,949	4,926
Hard maple	Indiana	689	--	--	--	689	1,694	277	1,971	2,660
	Other Central States	--	--	56	--	56	19	--	19	75
	Outside Central States	138	--	398	7	543	--	--	--	--
	Total	827	--	454	7	1,288	1,713	277	1,990	2,735
Soft maple	Indiana	52	--	--	--	52	31	--	31	83
	Other Central States	--	78	109	60	247	208	--	208	455
	Outside Central States	--	--	73	15	88	--	--	--	--
	Total	52	78	182	75	387	239	--	239	538
Red oak	Indiana	513	--	--	--	513	664	--	664	1,177
	Other Central States		48	625	6	679	452	--	452	1,131
	Outside Central States	32	104	760	3	899	--	--	--	--
	Total	545	152	1,385	9	2,091	1,116	--	1,116	2,308
White oak	Indiana	2,563	317	--	9	2,889	1,952	--	1,952	4,841
	Other Central States	--	87	49	42	178	116	--	116	294
	Outside Central States	467	41	1	1	510	--	--	--	--
	Total	3,030	445	50	52	3,577	2,068	--	2,068	5,135
Sycamore	Indiana	610	--	--	--	610	155	--	155	765
	Other Central States	--	141	1	82	224	97	--	97	321
	Outside Central States	--	44	--	286	330	--	--	--	--
	Total	610	185	1	368	1,164	252	--	252	1,086
Yellow poplar	Indiana	1,268	--	--	--	1,268	637	--	637	1,905
	Other Central States	-	13	13	--	26	--	--	--	26
	Outside Central States	--	--	--	55	55	--	--	--	--
	Total	1,268	13	13	55	1,349	637	--	637	1,931
Walnut	Indiana	6,089	2,315	1,540	230	10,174	2,949	--	2,949	13,123
	Other Central States	--	420	1,769	1,581	3,770	1,476	--	1,476	5,246
	Outside Central States	1,291	250	120	486	2,147	--	--	--	--
	Total	7,380	2,985	3,429	2,297	16,091	4,425	--	4,425	18,369
Misc. species	Indiana	453	16	--	33	502	618	15	633	1,135
	Other Central States	--	55	72	36	163	128	--	128	291
	Outside Central States	-	-	--	8	8	--	--	--	--
	Total	453	71	72	77	673	746	15	761	1,426
All species	Indiana	14,827	3,391	1,639	828	20,685	13,273	292	13,565	34,250
	Other Central States	186	2,898	3,621	2,738	9,443	5,059	--	5,059	14,502
	Outside Central States	2,004	887	2,422	1,524	6,837	--	--	--	--
	Total	17,017	7,176	7,682	5,090	36,965	18,332	292	18,624	48,752

1/ Production minus exports plus imports

2/ Illinois, Iowa, and Missouri were combined to avoid disclosure of individual mill operations.

REPORTS ON VENEER-LOG PRODUCTION
PUBLISHED BY
NORTH CENTRAL FOREST EXPERIMENT STATION

Lake States Veneer Log Production and Imports Show Slight Increase in 1956, by A. G. Horn. U.S.D.A. Forest Serv. Tech. Note 496, 2 p., illus. 1957.

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Veneer-Log Production and Consumption, North Central Region, 1966, by James E. Blyth. U.S.D.A. Forest Serv. Resource Bull. NC-5, 6 p., 1968.

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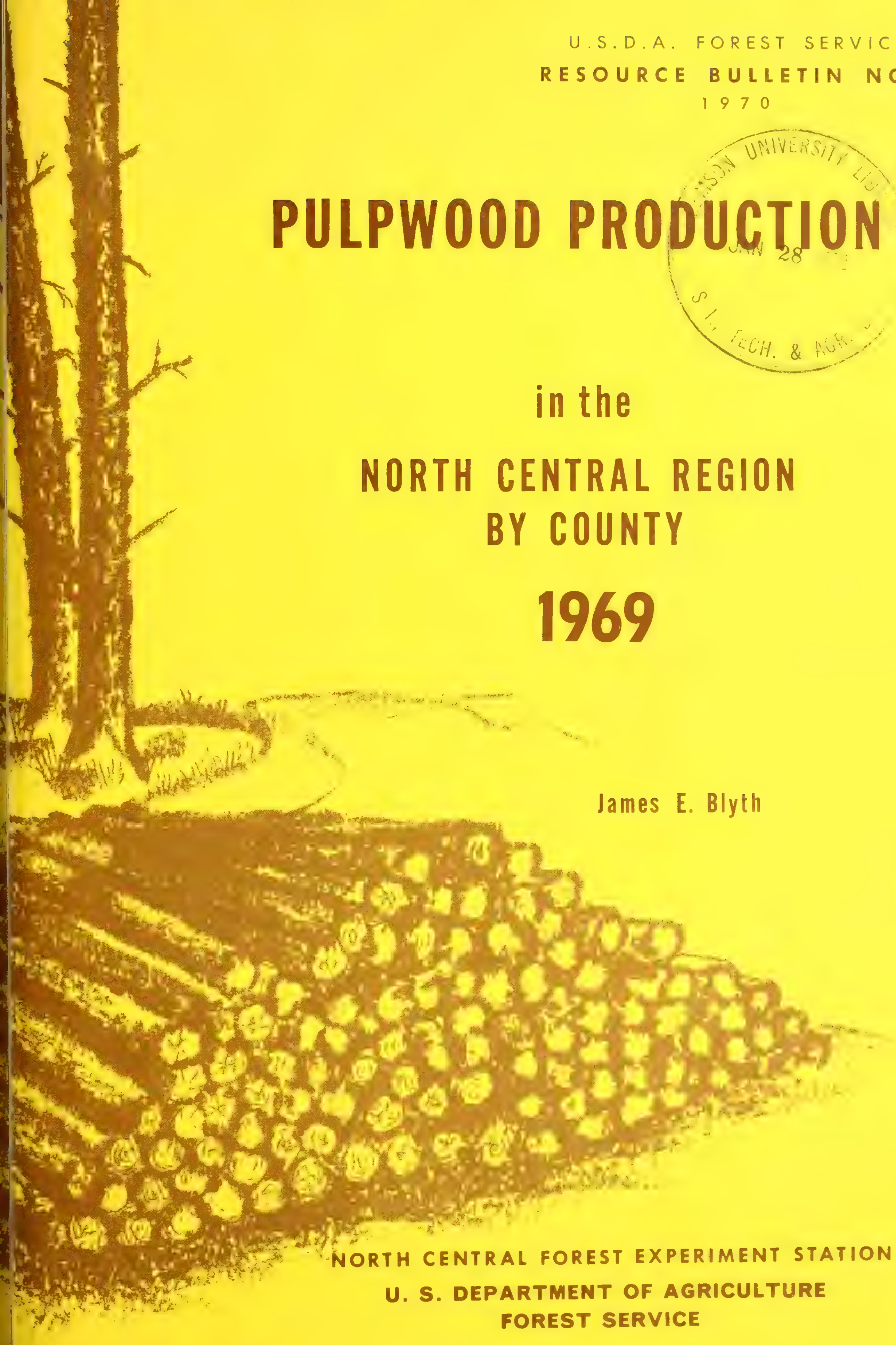
PULPWOOD PRODUCTION

in the

NORTH CENTRAL REGION BY COUNTY

1969



James E. Blyth

NORTH CENTRAL FOREST EXPERIMENT STATION
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

The author, a Market Analyst on the staff of the North Central Forest Experiment Station, is headquartered at the Station's main office in St. Paul, Minnesota, which is maintained in cooperation with the University of Minnesota.

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Pulpwood Production in the North Central Region, By County, 1969

James E. Blyth

This is the 11th annual report on the pulpvood harvest in Lake States counties and the 0th annual report on the Central States harest. The Lake States and Central States re discussed separately because the timber ypes in each area are different and less nformation can be released about the Central tates – more detailed data published on pulpvood production and receipts in the Central tates would reveal the operations of individual nills.

The pulpmills using North Central States imber in 1969 reported their pulpwood receipts y State and county. Their cooperation is grateully acknowledged. Thanks are also due to Ray Pfeifer, Staff Forester, Forest Resource Develpment, Michigan Department of Natural Reources, for collecting data on the Michigan ulpmills.

LAKE STATES

Lake States pulpwood production and reeipts[1] climbed to a more "normal" level in 969 after being depressed in 1968 by a oneuarter million cord cutback in Wisconsin pulpnill wood inventories. The 1969 production was early 7 percent of the national pulpwood proluction in 1968.

Production Rises 11 Percent

Lake States forests provided 3,944,000 cords of pulpwood in 1969, nearly 400,000 cords more than in 1968. More than 98 percent was consumed in the Lake States. Ninety-three percent was roundwood; the balance was residue[2] from local wood-using plants. Roundwood and residue used for pulping each rose 11 percent. Seventeen out of every 20 cords of Lake States residue delivered to pulpmills was in chip form.

More than half of the additional 400,000 cords was aspen. The rest was accounted for by increases of 86,000 cords in miscellaneous hardwoods, 53,000 cords in pine, and 25,000 cords in hemlock.

Not all softwood species shared in the larger harvest. Outputs of balsam fir and spruce were lower than at any time since World War II. Compared with 1968, the balsam fir harvest declined moderately, and spruce cutting dipped slightly. Tamarack production fell 8,000 cords.

At least two factors accounted for lower spruce-fir production during the last 5 years. One is the recent closing of several sulfite mills that used these species. The other is a substitution of other species and softwood plant residue for spruce-fir.

During the last 6 years, hardwood pulpwood has increased from 64 percent of the total Lake States pulpwood production to 70 percent (table 1).

---

[1] *Pulpwood production is defined as the pulpvood volume from timber lands in a specified rea that was received at all mills during 1968, vhereas pulpwood receipts are defined as the olume of wood received by mills in a specified rea regardless of the geographic source.*

[2] *Residue is byproducts from sawmills, veneer mills, cooperage mills, and other wood-using plants that are used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from these byproducts.*

Table 1.—*Increase in Lake States hardwood pulpwood production, 1964-1969*

Year	Hardwoods including residues		Softwoods including residues	
	Volume	Percent of total	Volume	Percent of total
	M cords		M cords	
1964	2,332	64	1,296	36
1965	2,347	64	1,289	36
1966	2,876	67	1,404	33
1967	2,710	68	1,255	32
1968	2,421	68	1,130	32
1969	2,777	70	1,167	30

One-fifth of the roundwood harvest was peeled before delivery. Most of the peeled wood was aspen. Loggers peeled over half the aspen cut in Wisconsin, nearly one-third in Michigan, and over one-fifth in Minnesota (fig. 1). The percent of peeled aspen varied greatly by Survey Unit in each State.

1969 Pulpwood Production by State

Of the 1969 Lake States pulpwood output, Wisconsin supplied 37 percent, Michigan 33 percent, and Minnesota 30 percent.

The distribution of the pulpwood harvest is shown in two ways: first, the amount of pulpwood cut relative to commercial forest area, and second, the amount of pulpwood cut relative to the merchantable volume in major pulpwood species.

The heaviest cutting per 1,000 acres of stocked commercial forest land was in a band of counties beginning in northern Minnesota and extending through northeastern Wisconsin, western Upper Michigan, and northern Lower Michigan (fig. 2). The rate of cutting per 1,000 cords of merchantable volume in principal pulpwood species was greatest in central Wisconsin and lowest in southern Wisconsin (fig. 3.)

Wisconsin harvest shifts northward. — Although the cutting intensity was highest in central Wisconsin, the 1969 rate was lower than in 1968. Harvesting increased significantly in northern counties. Top-producing counties were Oneida, Price, and Forest. Production climbed 20,000 cords or more in Forest, Langlade, Lincoln, Marinette, and Bayfield Counties.

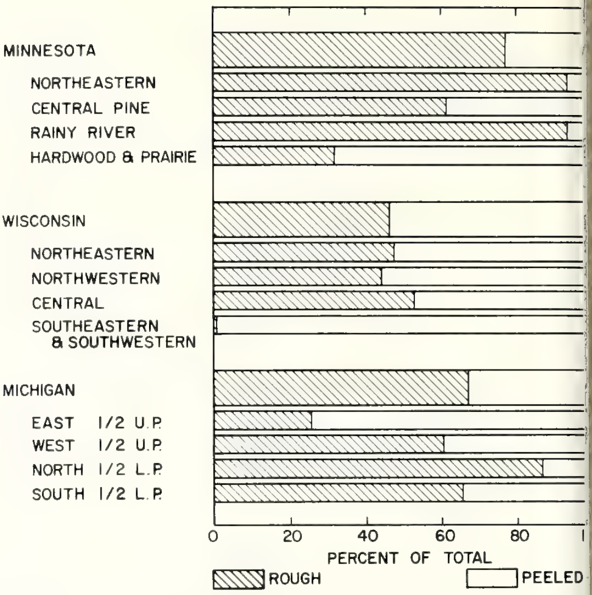

Figure 1.—Percent of rough and peeled aspe production of roundwood, by State and Fore Survey Unit, 1969.

Michigan production rebounds 11 percen —After a large drop in 1968, Michigan outpu climbed 134,000 cords in 1969. Use of Uppe Peninsula wood residue for pulp more than doubled. Only southern Lower Michigan failed t increase its output. Menominee, Iron, and Lak County loggers cut the largest pulpwood volume

Minnesota production near 1967 peak. - Minnesota produced nearly 1,200,000 cords pulpwood in 1969. More than two-thirds of th output increase occurred in the Central Pi Unit. The aspen cut was a record, 48,000 cor more than the previous high in 1966. Three larg counties — St. Louis, Koochiching, and Itasc provided 55 percent of the harvest.

Receipts Up 374,000 Cords

Forty-five Lake States plants receive about 4.4 million cords of pulpwood in 196 9 percent above the 1968 level. Of these plant 38 use aspen, 21 use spruce, and 17 use balsar fir (table 2). Two more mills began using woo chips in 1969 bringing the total to 13. Nine ou of 10 cords delivered were roundwood or chip manufactured from roundwood.

able 2.—*Number of plants using the dif- erent species of wood for pulping in 1969*

Species and kind of material	Lake States	Minn.	Wis.	Mich.
Aspen	38	9	22	7
Balsam fir	17	5	8	4
Birch	9	1	7	1
Hemlock	6	--	5	1
Pine	12	3	5	4
Spruce	21	5	12	4
Tamarack	4	1	3	--
Misc. hardwoods	14	2	8	4
Wood chips	13	3	7	3
Slabwood and other residue	5	--	4	1
Total plants	45	9	27	9

Regional mills procured more birch, softwood plant residue, and hardwood plant residue than ever before. Plant residue use has more than doubled since 1965. Most of the softwood residue is imported as chips from western States, whereas most of the hardwood residue is brought from Lake States sawmills and veneer mills.

Net imports from other States and Canada were more than 400,000 cords (table 3). For the first time, pulpwood imports from western States exceeded those from Canada. Softwood residue imports from western States reached a record high — nearly double the volume received in 1966. Two-thirds of the fiber from western States was softwood chips from mill residue. The rest was primarily roundwood (or chips from

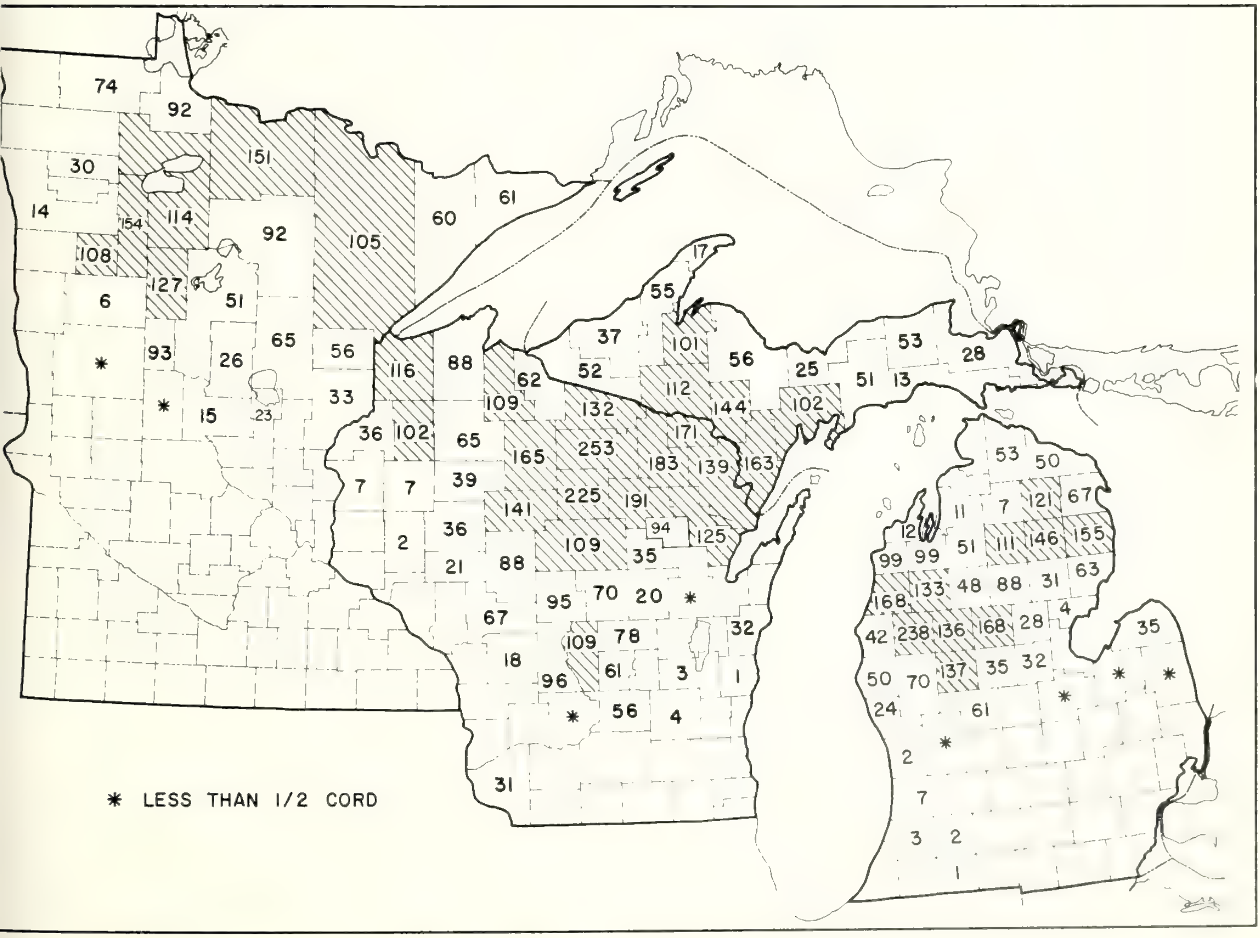

Figure 2.—Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1969. Crosshatching shows counties that supplied 100 or more cords of pulpwood per 1,000 acres of stocked commercial forest land.

Table 3.–*Pulpwood exports and imports for the Lake States, 1969*
(Thousand standard cords, unpeeled)

Species	Exports	Imports	Net exports or (imports)
Aspen	4	10	(6)
Birch	2	--	2
Balsam fir	1	--	1
Pine	1	144	(143)
Spruce	21	123	(102)
Mixed hardwoods	6	11	(5)
Residues, softwood	6	177	(171)
Residues, hardwood	12	10	2
Total	53	475	(422)

roundwood). By contrast, nearly all of the Canadian imports were pine and spruce roundwoo

Minnesota mills purchased a record 1,082,00 cords of pulpwood. Demand for aspen reached new high, and pine receipts were the largest sinc 1951 in Minnesota.

Three-fourths of the additional wood purchases went to Wisconsin. Wisconsin procure all but 10,000 cords of the western States' woo destined for the Lake States. Michigan receipt were off slightly because one pulpmill closed.

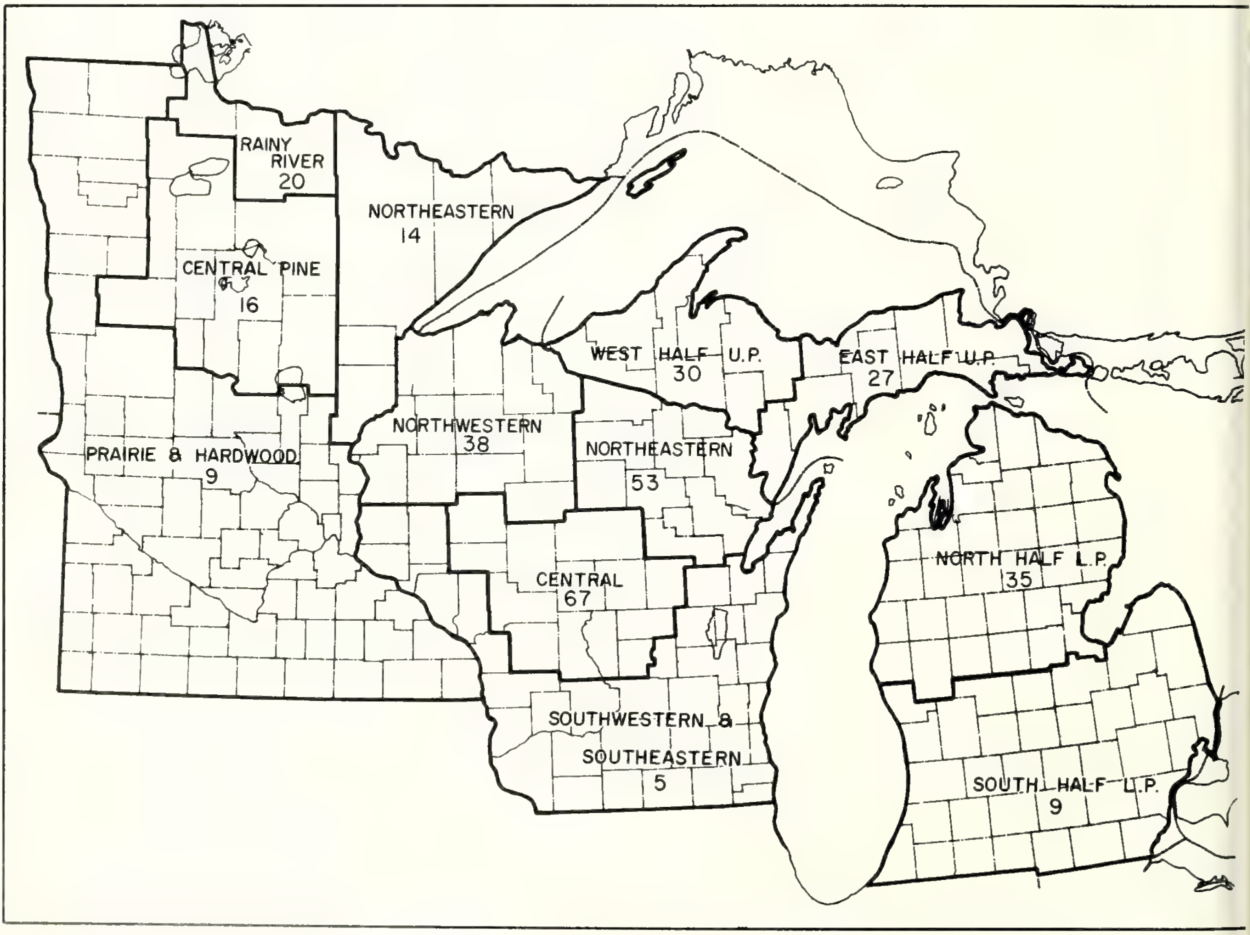

Figure 3.–Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species, by Forest Survey Unit, 1969. The heavy lines delineate the boundaries of the Forest Survey Units in each State.

Table 4.—*Active woodpulp mills in the Lake States, by location, type of pulp produced, and capacity, 1969*

Company	Location	Mill capacity in tons per 24 hours 1/				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Minnesota:						
Blandin Paper Co.	Grand Rapids	205	--	--	205	--
Hennepin Paper Co.	Little Falls	65	--	--	65	--
Boise Cascade Corp.	International Falls	750	--	300	450	--
Northwest Paper Co., The	Cloquet	425	120	305	--	--
Nu-Ply Corp.	Bemidji	75	--	--	75	--
St. Regis Paper Co.	Sartell	125	--	--	125	--
Superwood Corp.	Duluth	240	--	--	240	--
Hoerner Waldorf Corp.	St. Paul	300	--	--	--	300
Conwed Corp.	Cloquet	350	--	--	350	--
Total	9 plants	2,535	120	605	1,510	300
Wisconsin:						
American Can Co.	Green Bay	210	150	--	60	--
American Can Co.	Rothschild	190	190	--	--	--
Badger Paper Mills, Inc.	Peshtigo	90	90	--	--	--
Combined Paper Mills, Inc.	Combined Locks	175	--	--	175	--
Consolidated Papers, Inc.	Appleton	155	155	--	--	--
Consolidated Papers, Inc.	Stevens Point	100	--	--	100	--
Consolidated Papers, Inc.	Wisconsin Rapids	655	--	360	295	--
Green Bay Packaging, Inc.	Green Bay	200	--	--	--	200
Kansas City Star Co.	Park Falls	115	115	--	--	--
Kimberly-Clark Corp.	Kimberly	150	--	--	150	--
Kimberly-Clark Corp.	Niagara	150	--	--	150	--
Mosinee Paper Mills Co.	Mosinee	200	--	200	--	--
Nekoosa-Edwards Paper Co.	Nekoosa	310	--	310	--	--
Nekoosa-Edwards Paper Co.	Port Edwards	215	215	--	--	--
Owens-Illinois	Tomahawk	615	--	--	--	615
Charmin Paper Products Co.	Green Bay	2/	2/	--	2/	--
Charmin Paper Products Co.	Little Rapids	2/	--	--	2/	--
Scott Paper Co.	Marinette	50	50	--	--	--
Scott Paper Co.	Oconto Falls	110	110	--	--	--
St. Regis Paper Co.	Rhinelander	120	120	--	--	--
St. Regis Paper Co.	Cornell	50	--	--	50	--
Sterling Pulp & Paper Co.	Eau Claire	60	--	--	60	--
Superior Fiber Products Co.	Superior	180	--	--	180	--
Thilmany Pulp & Paper Co.	Kaukauna	375	--	375	--	--
Tomahawk Pulp Co., Inc.	Tomahawk	50	--	--	50	--
Wausau Paper Mills Co.	Brokaw	145	145	--	--	--
Evans Products Co.	Phillips	50	--	--	50	--
Total	27 plants	4,720	1,340	1,245	1,320	815
Michigan:						
Abitibi Corp.	Alpena	375	--	--	375	--
Celotex Corp.	L'Anse	270	--	--	270	--
Hoerner Waldorf Corp.	Ontonagon	250	--	--	--	250
Manistique Pulp & Paper Co.	Manistique	90	--	--	90	--
Mead Corp., The	Groos	100	--	--	100	--
Menasha Corp.	Otsego	225	--	--	--	225
Packaging Corp. of America	Filer City	600	--	200	--	400
Scott Paper Co.	Menominee	20	--	--	20	--
Warren Co., S.D.	Muskegon	225	--	225	--	--
Total	9 plants	2,155		425	855	875
All States	45 plants	9,410	1,460	2,275	3,685	1,990

1/ Lockwood's Directory of the Paper and Allied Industries-1970, and 1970 Directory of the Forest Products Industry.

2/ Capacity not available.

Regional Mill Capacity Expansion Nearly Offset Michigan Mill Closing

Despite the loss of a 170-ton-per-day Michigan sulfite mill, expansions at several other mills resulted in a net loss of only 20 tons of active regional daily mill capacity. Kraft mill capacity rose 100 tons of 2,275 tons per day (table 4). The increased pulpwood procurement in Minnesota partially resulted from the need for more wood after an 80-ton-per-day expansion in Minnesota mill capacity.

New Canadian Mill — Additional Outlet for Minnesota Wood

Construction of a 500-ton-per-day kraft pulpmill adjacent to Minnesota in Ontario is scheduled for completion in late 1971. This new facility should furnish northern Minnesota loggers with a larger pulpwood market. The $45 million mill will produce bleached and semibleached pulp.

The Hardwood Pulpwood Story in the Lake States

The annual harvest of Lake States hardwood pulpwood[3] has risen from 8,000 cords in 1946 to 465,000 cords in 1969 (fig. 4). The largest harvest was 484,000 cords in 1967. During this period the rate of increase in production was greatest from 1952 to 1956. From 1957 to the present, the rate of increase declined, but the annual harvest in the last 5 years averaged 437,000 cords, compared with 240,000 cords in 1957. During the last 7 years, use of hardwood plant byproducts (such as slabs, edgings, and veneer cores) for pulping in the Lake States rose rapidly and undoubtedly took the place of some hardwood roundwood. This substitution is probably the major reason for the slow rate of increase in use of round hardwood for pulp recently.

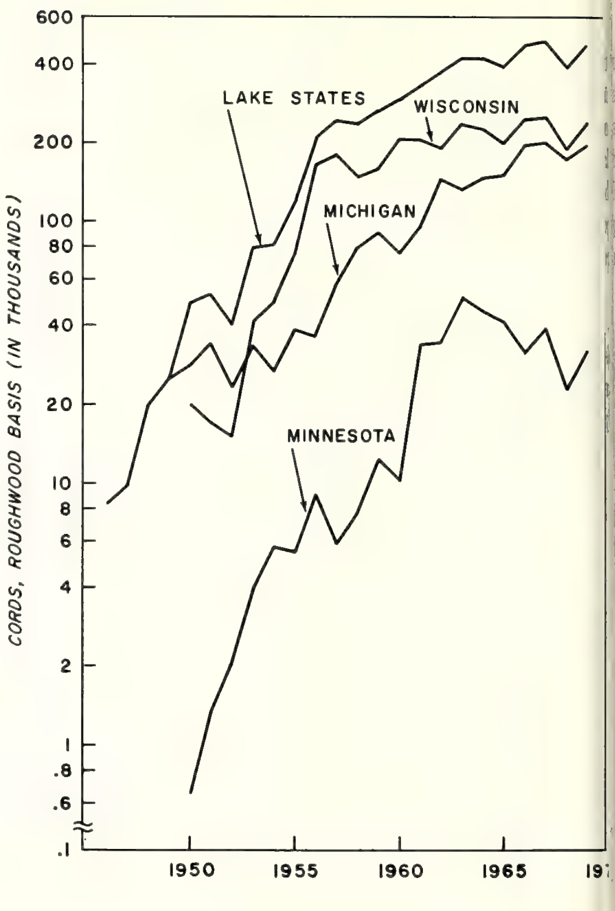

Figure 4.—Hardwood pulpwood production, by State in the Lake States, 1946-1969.

In the late forties nearly all of the hardwood pulpwood cut was in Michigan, but by 1953 Wisconsin took the lead. In 1956 the Wisconsin cut was more than four times as great as the Michigan cut. Since then cutting in Michigan has greatly expanded and is now approaching production in Wisconsin. Minnesota has always been a relatively small producer — the largest volume cut was 51,000 cords in 1963.

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[3] *Referred to as miscellaneous hardwoods in the tables of this and previous reports. Includes such species as red oak, white oak, hard maple, soft maple, ash, and elm. Aspen, birch and plant residues are excluded.*

Generally, hardwood pulpwood is used in he State where it is cut. Michigan exports about one-fifth of its harvest to Wisconsin mills, and very little to other States. Wisconsin mills have always used more than 94 percent of the local production. Except for 1967, more than 90 percent of the hardwood pulpwood used in Minnesota mills was cut locally.

Mixed hardwood pulpwood prices have risen slightly in Wisconsin since 1956. The following are delivered prices per rough cord (4- by 4-feet by 100 inches) in Wisconsin for selected years: [4]

Year	*Price range*
1956	$14.00-15.00
1957	$12.00-15.00
1958	$14.00-16.00
1959	$12.00-15.50
1960	$12.00-15.50
1961	$12.00-15.50
1962	$12.00-16.00
1967	$15.00-17.00
1968	$15.00-17.00
1969	$13.00-18.00

During the last 2 years the median delivered price in Wisconsin per rough mixed hardwood cord was $16.00 to $16.25. During this period only oak had a lower median price in Wisconsin.

Lake States pulpmills can usually obtain hardwoods at lower transportation costs than softwoods, because hardwood forests are closer to the mills. This is one of the reasons why the average delivered price per cord has been lower for hardwoods than for softwoods.

Use of hardwoods for pulp is expected to continue increasing with some substitution for softwoods. The rate of increase in round hardwood consumption will partially depend on the quantity of additional hardwood plant residue available to pulpmills.

CENTRAL STATES

Central States pulpwood production and receipts reached a record peak for the second straight year. New and expanding outlets for pulpwood in surrounding States was a major reason for the larger production. Wood procurement is shifting from roundwood to plant residue.

Output from Residue Greater Than from Roundwood

For the first time, plant residue constituted more than half of the total Central States pulpwood yield. The margin over roundwood was only 2,600 cords, but it emphasized a long-term shift away from pulpmill dependence on roundwood.

Total production rose to 376,000 cords in 1969, 13 percent above 1968 (table 5). Output from residue climbed 67,000 cords, while roundwood harvesting fell 24,000 cords, primarily in soft hardwoods.[5] Since 1965, pulpwood production from Central States plant residue has increased more than sevenfold.

Regional pulpwood exports to nearby States were 40,000 cords, more than twice those in 1968. Nearly three-fourths of the volume was hardwood plant residue. Most of the wood is exported from Illinois and Missouri.

Pulpwood production increased substantially in Illinois, Indiana, and Missouri. Iowa production declined to about the 1965 level. Until 1968, Iowa and Missouri were minor pulpwood-producing States compared with Indiana and Illinois. Since 1967, however, Missouri output has doubled while Iowa production has remained essentially stable.

In each of the Central States, sawmills, veneer mills, and cooperage mills sold more hard-

---

[4] *From selected issues of Wisconsin Forest Products Price Review, University of Wisconsin, Cooperative Extension Programs.*

[5] *Soft hardwoods include species such as elm, basswood, soft maple, yellow-poplar, and cottonwood. Hard hardwoods include oak, hard maple, beech, and hickory.*

Table 5.—*Central States pulpwood production and receipts, by State, 1969*

(In standard cords, unpeeled)[1]

Species group and destination	Production by States[2]					Imports			Total receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake States	Other U. S.	Total imports	
Softwoods									
Illinois	800	--	--	--	800	--	--	--	800
Ind., Iowa, Mo.[3]	120	--	40	--	160	140	--	140	300
Exported	--	64	--	--	64	--	--	--	--
Total	920	64	40	--	1,024	140	--	140	1,100
Soft hardwoods									
Illinois	29,139	1,302	--	133	30,574	1,932	--	1,932	32,506
Ind., Iowa, Mo.[3]	5,495	35,217	8,031	17,731	66,474	5,865	2,238	8,103	74,577
Exported[4]	158	920	--	190	1,268	--	--	--	--
Total	34,792	37,439	8,031	18,054	98,316	7,797	2,238	10,035	107,083
Hard hardwoods									
Illinois	12,878	3,927	--	328	17,133	--	--	--	17,133
Ind., Iowa, Mo.[3]	8,784	41,911	8,780	5,035	64,510	4,380	2,053	6,433	70,943
Exported[4]	458	4,316	--	1,064	5,838	--	--	--	--
Total	22,120	50,154	8,780	6,427	87,481	4,380	2,053	6,433	88,076
Total roundwood									
Illinois	42,817	5,229	--	461	48,507	1,932	--	1,932	50,439
Ind., Iowa, Mo.[3]	14,399	77,128	16,851	22,766	131,144	10,385	4,291	14,676	145,820
Exported[4]	616	5,300	--	1,254	7,170	--	--	--	--
Total	57,832	87,657	16,851	24,481	186,821	12,317	4,291	16,608	196,259
Residues, softwood									
Illinois	908	--	1,501	--	2,409	4,188	4,505	8,693	11,102
Ind., Iowa, Mo.[3]	--	--	--	--	--	--	4,616	4,616	4,616
Exported[4]	--	4,494	--	--	4,494	--	--	--	--
Total	908	4,494	1,501	--	6,903	4,188	9,121	13,309	15,718
Residues, hardwood									
Illinois	57,358	1,002	--	46,916	105,276	6,931	11,811	18,742	124,018
Ind., Iowa, Mo.[3]	13,336	23,063	12,274	412	49,085	4,591	5,384	9,975	59,060
Exported[4]	3,000	15,402	954	8,800	28,156	--	--	--	--
Total	73,694	39,467	13,228	56,128	182,517	11,522	17,195	28,717	183,078
All wood material									
Illinois	101,083	6,231	1,501	47,377	156,192	13,051	16,316	29,367	185,559
Ind., Iowa, Mo.[3]	27,735	100,191	29,125	23,178	180,229	14,976	14,291	29,267	209,496
Exported[4]	3,616	25,196	954	10,054	39,820	--	--	--	--
Total	132,434	131,618	31,580	80,609	376,241	28,027	30,607	58,634	395,055

[1] Factors used in converting to standard green cords (128 cu. ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

[2] Vertical columns of figures under box heading "Production by States" present the amount of pulpwood cut in each State.

[3] Combined to prevent disclosure of individual mill receipts.

[4] Pulpwood shipped to mills outside the region.

wood residue to pulpmills than ever before. About half of the increase over 1968 was in Illinois.

Illinois harvested less roundwood in 1969 than any year since 1957. Harvesting fell in Iowa but remained steady in Indiana and Missouri, as shown in the 5-year summary below:

	In thousand cords				
State	*1965*	*1966*	*1967*	*1968*	*1969*
llinois	77	97	69	76	58
ndiana	82	94	69	87	88
owa	25	27	27	25	17
Missouri	20	19	21	23	24
Total	204	237	186	211	187

The number of Central States counties supplying roundwood increased from 111 in 1968 to 122 in 1969. Of these, 44 were in Indiana, 42 in Illinois, 23 in Missouri, and 13 in Iowa (fig. 5). Top-producing counties in each State were Lawrence and Gibson in Indiana, Wabash and Pulaski n Illinois, Carroll and Clark in Missouri, and Lee and Des Moines in Iowa.

Receipts Approach 400,000 Cords

Central States pulpmills received 8 percent more pulpwood in 1969 than in 1968. Roundwood receipts dropped 28,000 cords, while residue purchases increased 57,000 cords (table 6). As a result, residue receipts had a 2,500 cord margin over roundwood receipts. Previously roundwood had always been the major type of pulpwood consumed.

Central States producers supplied 21,000 more cords of wood to local mills than in 1968. Imports from other States rose 8,000 cords but were only 15 percent of all wood purchases.

The eight pulpmills in Illinois bought 47 percent of all pulpwood in the region, including two-thirds of the wood residue. Of the 29,000-cord increase in wood receipts in 1969, all but 3,500 cords went to Illinois plants.

Table 6.—*Trends in receipts (standard cords, unpeeled) of roundwood and residue as pulpwood, Central States, 1965-1969*

Type of material and area	1965	1966	1967	1968	1969
Roundwood					
Illinois	68	84	63	68	50
Indiana, Iowa, Missouri	143	163	138	156	146
Total	211	247	201	224	196
Residue					
Illinois	22	25	50	92	135
Indiana, Iowa, Missouri	24	29	37	50	64
Total	46	54	87	142	199
All material	257	301	288	366	395

Pulping of residue will probably continue increasing for several reasons. Some additional sawmills will install debarkers and chippers to upgrade their residue to the quality needed by pulpmills. Some pulpmills have had difficulty obtaining roundwood because woods labor was scarce, but have found other primary wood-using mills to be reliable suppliers of wood chips from their plant byproducts. Less woodyard space is required at pulpmills when chips from byproducts are substituted for roundwood. Finally, new pollution control laws restricting burning of waste material may stimulate primary mills to locate pulpwood outlets for their byproducts.

Active Pulpmill Capacity Rises; Indiana Mill to Close in 1970

Fifteen active Central States pulpmills had a daily capacity of 1,630 tons in 1969, 70 tons greater than in 1968 (table 7). However, an Indiana plant will close its 120-ton-per-day semichemical pulpmill in 1970 and use wastepaper as a raw material. No major expansions at the other 14 mills have been announced.

Figure 5.—Harvest of pulpwood bolts in the Central States by Counties, in standard cords, 1969.

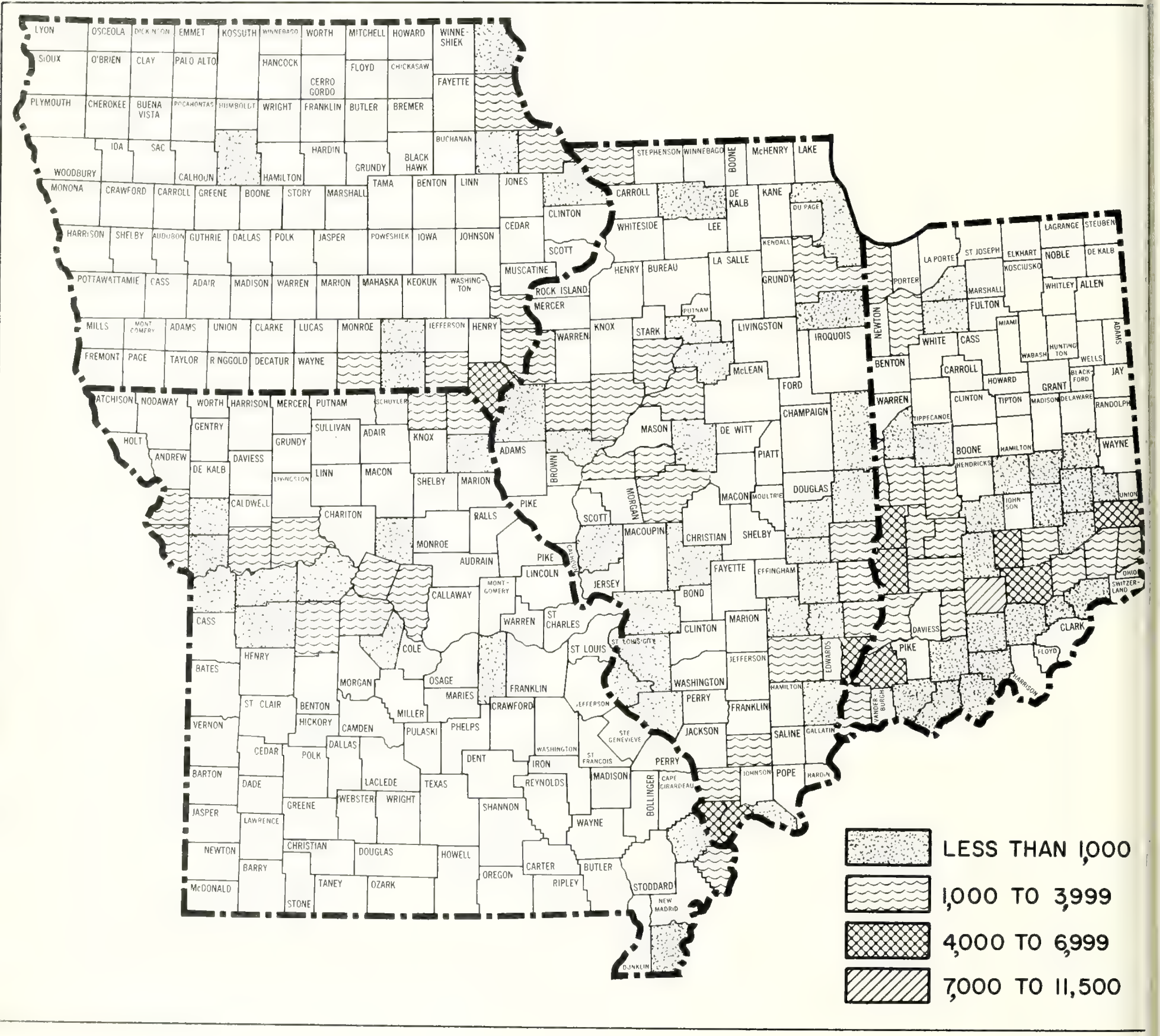


Table 7.—*Active woodpulp mills in the Central States by location, type of pulp produced, and capacity, 1969*

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Illinois:						
Philip Carey Corp.	Wilmington	30	--	--	30	--
Celotex Corp.	Peoria	190	--	--	190	--
Alton Box Board Co.	Alton	300	--	--	--	300
Bird & Son, Inc.	Chicago	40	--	--	40	--
Certain-Teed Products Corp.	East St. Louis	100	--	--	100	--
Flintkote Co., The	Mt. Carmel	40	--	--	40	--
Johns-Manville Products Corp.	Waukegan	65	--	--	65	--
GAF Corp.	Joliet	100	--	--	100	--
Total	8 plants	865	--	--	565	300
Indiana:						
Container Corp. of America	Carthage	120	--	--	--	120
Weston Paper & Manufacturing Co.	Terre Haute	250	--	--	--	250
Total	2 plants	370	--	--	--	370
Iowa:						
Celotex Corp.	Dubuque	90	--	--	--	90
Consolidated Packaging Corp.	Fort Madison	135	--	--	--	135
United States Gypsum Co.	Fort Dodge	[2]	--	--	--	--
Total	3 plants	225	--	--	--	225
Missouri:						
Huebert Fiberboard, Inc.	Booneville	60	--	--	60	--
GAF Corp.	Kansas City	110	--	--	110	--
Total	2 plants	170	--	--	170	--
All States	15 plants	1,630	--	--	735	895

[1] Lockwood's Directory of the Paper and Allied Industries-1970, and 1970 Directory of the Forest Products Industry.

[2] Capacity not available.

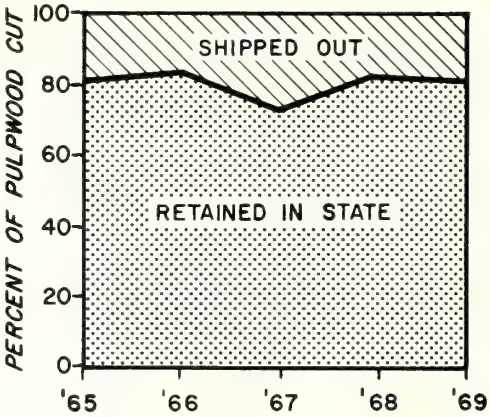
APPENDIX

Table 8.—*Lake States pulpwood production, by State of origin and destination, 1965-1969*

MINNESOTA

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1965	1,018	842	159	--	17
1966	1,174	970	193	*	11
1967	1,205	884	299	*	22
1968	1,087	900	166	*	21
1969	1,192	977	188	--	27
5-year average	1,135	914	201	*	20

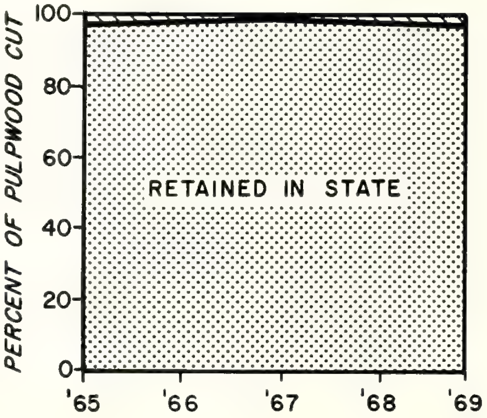
*Less than 500 cords.



WISCONSIN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1965	1,253	8	1,225	1	19
1966	1,536	13	1,501	3	19
1967	1,416	15	1,387	*	14
1968	1,297	22	1,259	4	12
1969	1,450	17	1,412	9	12
5-year average	1,390	15	1,357	3	15

*Less than 500 cords.



MICHIGAN

Year	Total cut	Destination of pulpwood			
		Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1965	1,365	--	608	750	7
1966	1,570	1	666	901	2
1967	1,344	--	660	684	*
1968	1,168	--	455	702	11
1969	1,302	--	537	752	13
5-year average	1,350	*	585	758	7

*Less than

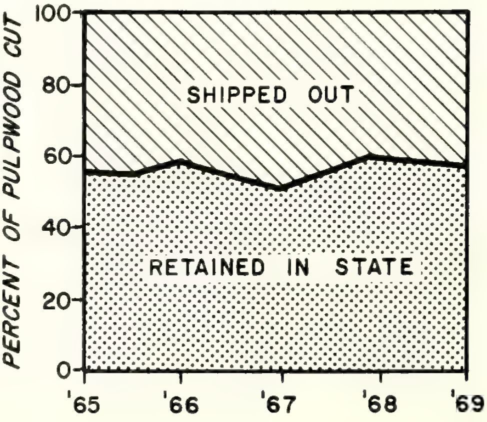


Table 9.–*Lake States pulpwood production, by Forest Survey Unit and destination by State, 1969*

(Thousand standard cords, roughwood basis)

MINNESOTA

Unit	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	437	328	106	--	3
Central Pine	437	363	69	--	5
Rainy River	253	225	8	--	20
Hardwood & Prairie	65	61	4	--	--
Total	1,192	977	187	--	28

WISCONSIN

Unit	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
Northeastern	709	--	699	9	1
Northwestern	478	6	472	--	*
Central	213	3	210	--	*
Southeastern & Southwestern	50	8	32	--	10
Total	1,450	17	1,413	9	11

MICHIGAN

Unit	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
E. 1/2 Up. Pen.	277	--	197	68	12
W. 1/2 Up. Pen.	402	--	340	61	1
N. 1/2 Low. Pen.	575	--	--	575	--
S. 1/2 Low. Pen.	48	--	--	48	--
Total	1,302	--	537	752	13

*Less than 500 cords.

Table 10.—*Lake States pulpwood production by species, State, and Forest Survey Unit, 1965-1969*

(Thousand standard cords, roughwood basis)

MINNESOTA

Unit	ASPEN					BALSAM FIR				
	Annual production					Annual production				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
Northeastern	177	205	205	203	204	22	20	26	12	10
Central Pine	186	272	265	218	289	23	35	30	18	18
Rainy River	96	123	108	131	148	28	25	20	13	12
Prairie & Hardwood	9	12	13	31	19	*	--	--	*	--
Total	468	612	591	583	660	73	80	76	43	40
WISCONSIN										
Northeastern	341	449	430	369	416	25	28	26	25	28
Northwestern	220	298	273	202	244	24	26	21	22	22
Central	45	61	35	55	35	1	1	*	4	*
Southeastern & Southwestern	2	2	1	3	2	--	--	*	--	--
Total	608	810	739	629	697	50	55	47	51	50
MICHIGAN										
E. 1/2 Up. Pen.	142	156	144	95	119	41	48	50	39	27
W. 1/2 Up. Pen.	207	222	237	167	184	30	37	38	22	16
N. 1/2 Low. Pen.	341	388	258	274	296	2	3	3	1	1
S. 1/2 Low. Pen.	14	10	7	5	7	--	--	--	--	--
Total	704	776	646	541	606	73	88	91	62	44
LAKE STATES	1,780	2,198	1,976	1,753	1,963	196	223	214	156	134

*Less than 500 cords.

(Continued on next page)

(Table 10 continued)

MINNESOTA

Unit	BIRCH					HEMLOCK				
	Annual production					Annual production				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
Northeastern	--	--	1	*	3	--	--	--	--	--
Central Pine	*	1	2	1	*	--	--	--	--	--
Rainy River	--	--	--	--	--	--	--	--	--	--
Prairie & Hardwood	--	--	--	--	--	--	--	--	--	--
Total	*	1	3	1	3	--	--	--	--	--
WISCONSIN										
Northeastern	5	9	28	18	23	37	48	27	22	32
Northwestern	17	26	46	35	37	21	18	13	18	16
Central	2	4	10	3	3	2	3	2	4	3
Southeastern & Southwestern	*	--	*	*	--	--	--	--	*	--
Total	24	39	84	56	63	60	69	42	44	51
MICHIGAN										
E. 1/2 Up. Pen.	5	3	3	2	1	9	21	16	9	11
W. 1/2 Up. Pen.	1	2	2	*	1	55	78	44	36	52
N. 1/2 Low. Pen.	26	8	6	11	21	--	--	--	--	*
S. 1/2 Low. Pen.	--	--	--	--	*	--	--	--	--	--
Total	32	13	11	13	23	64	99	60	45	63
LAKE STATES	56	53	55	70	89	124	168	102	89	114

*Less than 500 cords.

(Continued on next page)

(Table 10 continued)

MINNESOTA

Unit	JACK PINE[1]					SPRUCE				
	Annual production					Annual production				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
Northeastern	101	138	108	121	133	106	78	93	66	66
Central Pine	56	85	69	62	74	38	31	45	31	27
Rainy River	12	15	11	12	18	92	61	79	60	60
Prairie & Hardwood	12	18	14	8	12	2	2	1	*	1
Total	181	256	202	203	237	238	172	218	157	154
WISCONSIN										
Northeastern	57	58	45	46	63	10	14	10	7	10
Northwestern	76	92	61	57	77	5	4	3	3	3
Central	72	64	67	94	75	*	*	*	1	*
Southeastern & Southwestern	1	1	1	2	1	--	--	--	--	--
Total	206	215	174	199	216	15	18	13	11	13
MICHIGAN										
E. 1/2 Up. Pen.	66	63	40	39	59	28	31	33	23	20
W. 1/2 Up. Pen.	47	47	36	33	38	36	42	40	16	18
N. 1/2 Low. Pen.	110	138	115	131	109	1	1	2	*	1
S. 1/2 Low. Pen.	1	2	2	2	1	--	--	--	--	--
Total	224	250	193	205	207	65	74	75	39	39
LAKE STATES	611	721	569	607	660	318	264	306	207	206

*Less than 500 cords.

[1] Includes small quantity of red and white pine.

(Continued on next page)

(Table 10 continued)

MINNESOTA

Unit	TAMARACK					MISC. HARDWOODS				
	Annual production					Annual production				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
Northeastern	5	1	6	4	4	4	4	9	7	11
Central Pine	6	6	27	16	14	24	13	6	5	11
Rainy River	--	*	4	4	2	10	13	23	9	8
Prairie & Hardwood	1	*	3	1	1	3	1	1	2	2
Total	12	7	40	25	21	41	31	39	23	32
WISCONSIN										
Northeastern	1	1	2	3	1	56	80	64	60	87
Northwestern	3	2	1	2	1	56	70	62	50	61
Central	--	*	--	*	*	77	84	71	68	81
Southeastern & Southwestern	*	--	--	--	--	9	8	6	7	9
Total	4	3	3	5	2	198	242	203	185	238
MICHIGAN										
E. 1/2 Up. Pen.	2	1	1	1	1	8	16	6	3	10
W. 1/2 Up. Pen.	1	*	*	1	1	63	70	79	48	38
N. 1/2 Low. Pen.	*	--	--	--	--	75	103	112	116	141
S. 1/2 Low. Pen.	--	--	--	--	--	3	5	2	4	7
Total	3	1	1	2	2	149	194	199	171	196
LAKE STATES	19	11	44	32	25	388	467	484	379	466

*Less than 500 cords.

(Continued on next page)

(Table 10 continued)

MINNESOTA

Unit	RESIDUES					ALL SPECIES[1]				
	Annual production					Annual production				
	1965	1966	1967	1968	1969	1965	1966	1967	1968	1969
Northeastern	1	3	11	8	6	416	449	459	421	437
Central Pine	2	6	9	12	4	335	449	453	363	437
Rainy River	--	--	4	11	5	238	237	249	240	253
Prairie & Hardwood	2	6	12	21	30	29	39	44	63	65
Total	5	15	36	52	45	1,018	1,174	1,205	1,087	1,192
WISCONSIN										
Northeastern	51	49	41	53	49	583	736	673	603	709
Northwestern	8	7	22	21	17	430	543	502	410	478
Central	6	5	22	16	16	205	222	207	245	213
Southeastern & Southwestern	23	24	26	27	38	35	35	34	39	50
Total	88	85	111	117	120	1,253	1,536	1,416	1,297	1,450
MICHIGAN										
E. 1/2 Up. Pen.	5	11	2	2	29	306	350	295	213	277
W. 1/2 Up. Pen.	26	23	32	34	54	466	521	508	357	402
N. 1/2 Low. Pen.	--	3	11	16	6	555	644	507	549	575
S. 1/2 Low. Pen.	20	38	23	38	33	38	55	34	49	48
Total	51	75	68	90	122	1,365	1,570	1,344	1,168	1,302
LAKE STATES	144	175	215	259	287	3,636	4,280	3,965	3,552	3,944

[1] Including residues.

Table 11.—*Lake States pulpwood production by county and species, 1969*

(Thousand standard cords, roughwood basis)

WISCONSIN

Unit and county[1/]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residues[2/]
NORTHEASTERN:										
Florence	44	36	1	*	2	2	1	--	2	
Forest	95	63	4	2	11	2	1	*	12	
Langlade	72	51	1	4	1	1	*	*	14	
Lincoln	89	57	2	3	1	7	1	*	18	
Marinette	89	59	9	1	4	8	2	*	6	
Menominee	20	13	--	--	7	*	--	--	--	
Oconto	44	34	1	*	2	5	*	*	2	
Oneida	142	70	8	9	2	24	4	1	24	
Shawano	9	5	*	*	1	*	*	*	3	
Vilas	56	28	2	4	1	14	1	*	6	
Total	709	416	28	23	32	63	10	1	87	49
NORTHWESTERN:										
Ashland	56	32	6	2	4	4	1	--	7	
Barron	1	*	--	*	--	--	--	--	1	
Bayfield	66	38	1	5	1	19	*	*	2	
Burnett	11	3	*	*	--	8	--	*	*	
Douglas	70	46	*	1	--	23	*	--	*	
Iron	23	11	2	2	3	1	*	--	4	
Polk	1	*	--	--	--	1	*	--	*	
Price	97	46	8	16	3	2	1	*	21	
Rusk	12	8	*	1	*	*	--	--	3	
Sawyer	39	18	4	6	2	3	1	*	5	
Taylor	50	25	1	4	3	1	*	*	16	
Washburn	35	17	*	*	--	15	*	1	2	
Total	478	244	22	37	16	77	3	1	61	17
CENTRAL:										
Adams	27	*	--	--	--	14	--	--	13	
Chippewa	7	6	*	*	*	1	*	--	*	
Clark	23	8	*	*	*	4	--	--	11	
Eau Claire	3	*	--	--	--	3	--	--	*	
Jackson	22	*	--	--	--	21	--	--	1	
Juneau	22	1	--	*	--	16	--	--	5	
Marathon	40	13	*	3	3	1	*	*	20	
Marquette	6	--	--	--	--	*	--	--	6	
Monroe	4	1	--	--	--	3	--	--	*	
Portage	11	2	*	--	*	3	*	*	6	
Waupaca	3	2	*	*	*	*	--	*	1	
Waushara	9	*	--	--	--	3	--	--	6	
Wood	20	2	*	--	*	6	--	*	12	
Total	213	35	*	3	3	75	*	*	81	16

(Continued on next page)

(Table 11 continued)

WISCONSIN (continued)

Unit and county[1]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residues[2]
SOUTHWESTERN:										
Dunn	*	*	--	--	--	*	--	--	--	
Grant	5	--	--	--	--	--	--	--	5	
Sauk	*	--	--	--	--	*	--	--	--	
Total	32	*	--	--	--	*	--	--	5	27
SOUTHEASTERN:										
Columbia	5	--	--	--	--	1	--	--	4	
Dodge	*	--	--	--	--	--	--	--	*	
Fond du lac	*	--	--	--	--	--	--	--	*	
Manitowoc	2	2	--	--	--	--	--	--	--	
Outagamie	*	*	--	--	--	--	--	--	*	
Sheboygan	*	--	--	--	--	--	--	--	*	
Total	18	2	--	--	--	1	--	--	4	11
State total	1,450	697	50	63	51	216	13	2	238	120

[1] Includes only those counties that supplied pulpwood in 1969.

[2] County figures are not available.

* Less than 500 cords.

(Continued on next page)

(Table 11 continued)

MICHIGAN

Unit and county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues[2]
E. 1/2 UP. PEN.:										
Alger	13	2	1	--	1	7	1	--	1	
Chippewa	21	6	*	*	1	9	2	1	2	
Delta	63	31	9	*	3	11	7	*	2	
Luce	28	2	3	--	2	17	3	*	1	
Mackinac	7	1	2	*	*	2	1	--	1	
Menominee	83	65	9	1	2	*	4	*	2	
Schoolcraft	33	12	3	*	2	13	2	*	1	
Total	277	119	27	1	11	59	20	1	10	29
W. 1/2 UP. PEN.:										
Baraga	54	23	*	1	11	6	1	*	12	
Dickinson	64	52	2	--	2	2	5	1	*	
Gogebic	33	11	1	*	11	2	*	*	8	
Houghton	30	11	1	*	12	2	2	*	2	
Iron	76	48	4	--	6	2	2	*	14	
Keweenaw	4	--	2	--	--	--	2	*	--	
Marquette	61	23	4	--	3	24	6	*	1	
Ontonagon	26	16	2	--	7	*	*	--	1	
Total	402	184	16	1	52	38	18	1	38	54
N. 1/2 LOW. PEN.:										
Alcona	49	35	*	2	--	1	--	--	11	
Alpena	14	9	*	1	--	1	*	--	3	
Antrim	2	2	--	*	--	--	--	--	*	
Arenac	*	*	--	*	--	*	--	--	*	
Benzie	12	9	--	1	--	*	--	--	2	
Cheboygan	18	13	*	2	--	1	*	--	2	
Clare	37	25	--	2	--	3	--	--	7	
Crawford	33	9	--	1	--	21	--	--	2	
Gladwin	5	4	--	*	--	*	--	--	1	
Grand Traverse	16	10	--	1	--	2	--	--	3	
Iosco	15	3	--	*	--	10	--	--	2	
Isabella	3	3	--	*	--	--	--	--	*	
Kalkaska	14	9	--	*	--	3	--	--	2	
Lake	69	20	--	1	--	12	--	--	36	
Leelanau	1	1	--	*	--	--	--	--	--	
Manistee	36	12	--	1	*	1	--	--	22	
Mason	6	2	--	*	--	2	--	--	2	
Mecosta	19	15	--	*	--	*	--	--	4	
Midland	5	5	--	*	--	*	--	--	*	
Missaukee	11	8	--	*	--	1	--	--	2	
Montmorency	35	18	*	2	--	7	1	--	7	
Newaygo	21	9	--	*	--	2	--	--	10	
Oceana	7	2	--	*	--	2	--	--	3	
Ogemaw	7	3	--	*	--	3	--	--	1	
Osceola	23	18	--	*	--	*	--	--	5	
Oscoda	43	15	*	2	--	23	*	--	3	
Otsego	2	*	--	--	--	2	--	--	--	
Presque Isle	14	7	1	2	--	*	*	--	4	
Roscommon	23	14	*	2	--	3	*	--	4	
Wexford	29	16	--	1	--	9	--	--	3	
Total	575	296	1	21	*	109	1	--	141	6

(Continued on next page)

(Table 11 continued)

MICHIGAN (continued)

Unit and county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues[2]
S. 1/2 LOW. PEN.:										
Allegan	1	*	--	--	--	--	--	--	1	
Huron	2	2	--	--	--	--	--	--	--	
Kalamazoo	*	*	--	--	--	*	--	--	*	
Kent	*	--	--	--	--	*	--	--	--	
Montcalm	8	4	--	*	--	*	--	--	4	
Muskegon	4	1	--	--	--	1	--	--	2	
Ottawa	*	*	--	--	--	*	--	--	*	
Saginaw	*	--	--	--	--	*	--	--	--	
St. Joseph	*	*	--	--	--	--	--	--	*	
Sanilac	*	*	--	--	--	--	--	--	--	
Tuscola	*	*	--	--	--	--	--	--	--	
Van Buren	*	--	--	--	--	--	--	--	*	
Total	48	7	--	*	--	1	--	--	7	33
State total	1,302	606	44	23	63	207	39	2	196	122

[1] Includes only those counties that supplied pulpwood in 1969.
[2] County figures are not available.
* Less than 500 cords.

(Continued on next page)

(Table 11 continued)

MINNESOTA

Unit and county 1/	All species	Aspen	Balsam	Birch	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues 2/
NORTHEASTERN:									
Carlton	17	13	1	2	1	*	*	--	
Cook	40	*	1	--	8	31	*	--	
Lake	61	12	1	--	31	16	1	--	
Pine	12	9	*	--	1	*	*	2	
St. Louis	301	170	7	1	92	19	3	9	
Total	437	204	10	3	133	66	4	11	6
CENTRAL PINE:									
Aitkin	46	37	1	--	1	3	4	--	
Becker	2	2	*	--	--	*	*	--	
Beltrami	93	59	6	*	16	6	2	4	
Cass	47	32	1	*	9	1	1	3	
Clearwater	50	37	1	--	4	2	2	4	
Crow Wing	11	3	*	--	8	*	--	--	
Hubbard	52	40	*	--	11	1	*	*	
Itasca	121	75	9	--	18	14	5	*	
Wadena	11	4	--	--	7	--	--	--	
Total	437	289	18	*	74	27	14	11	4
RAINY RIVER:									
Koochiching	212	145	12	--	12	34	1	8	
Lake of the Woods	36	3	*	--	6	26	1	--	
Total	253	148	12	--	18	60	2	8	5
HARDWOOD:									
Mille Lacs	3	2	--	--	--	*	--	1	
Morrison	3	3	--	--	*	--	--	--	
Ottertail	*	*	--	--	--	--	--	--	
Todd	*	*	--	--	--	--	--	--	
Total	36	5	--	--	*	*	--	1	30
PRAIRIE:									
Mahnomen	13	11	--	--	--	1	--	1	
Pennington	1	1	--	--	--	--	--	--	
Polk	1	--	--	--	--	--	1	--	
Roseau	14	2	--	--	12	*	*	--	
Total	29	14	--	--	12	1	1	1	--
State total	1,192	660	40	3	237	154	21	32	45

1/ Includes only those counties that supplied pulpwood in 1969.
2/ County figures are not available.
* Less than 500 cords.

Recent Reports on Pulpwood Production
Published by the
North Central Forest Experiment Station

Pulpwood production in Lake States Counties, by Arthur G. Horn:

1960 data: Station Paper 94, 28 p.
1961 data: Station Paper 106, 18 p.
1962 data: Research Paper LS-5, 16 p.
1963 data: Resource Bulletin LS-1, 17 p.
1964 data: Resource Bulletin LS-2, 19 p.

Pulpwood Production in the North Central Region by County, by James E. Blyth:

1965 data: Resource Bulletin NC-2, 24 p.
1966 data: Resource Bulletin NC-3, 27 p.
1967 data: Resource Bulletin NC-6, 23 p.
1968 data: Resource Bulletin NC-8, 22 p.

Brief Notes for the past 10 years are:

1960: Tech. Note 606
1961: Tech. Note 624
1962: Research Note LS-23
1963: Research Note LS-48
1964: Research Note LS-65
1965: Research Note NC-3
1966: Research Note NC-31
1967: Research Note NC-59
1968: Research Note NC-86
1969: Research Note NC-100

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USDA Forest Service
Resource Bulletin NC-12
1971

BY JAMES E. BLYTH & ALLEN H. BOELTER

rimary forest products industry & industrial undwood production, Michigan, 1969

ORTH CENTRAL FOREST EXPERIMENT STATION • FOREST SERVICE • U.S. DEPARTMENT OF AGRICULTURE

The authors are, respectively, Market Analyst for the Station, and Staff Forester for the Michigan Department of Natural Resources, Lansing, Michigan.

COVER PHOTO: Courtesy of Michigan Department of Natural Resources Lansing, Michigan.

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(Maintained in cooperation with the University of Minnesota)

PRIMARY FOREST PRODUCTS INDUSTRY AND INDUSTRIAL ROUNDWOOD PRODUCTION, MICHIGAN, 1969

James E. Blyth and Allen H. Boelter

FOREWORD

Data for this publication came from a complete canvass of primary wood-using firms using Michigan logs and bolts. All canvassing in Michigan was done by the Forestry Division, Michigan Department of Natural Resources, using mail questionnaires and following up on nonrespondents by telephone or personal contact. The North Central Forest Experiment Station, using similar procedures, contacted out-of-State mills and received data from railroads operating in Michigan on the volume of logs loaded on cars in Michigan with a seaport destination. The Station edited and compiled the data.

RECENT TRENDS — FEWER MILLS BUT MORE OUTPUT

Michigan loggers cut 173.8 million cubic feet of industrial roundwood products in 1969, slightly less than in 1965 but 24 million cubic feet more than in 1954 (table 1). Ninety percent of the 1969 output was pulpwood and saw logs; the remainder was veneer logs, poles, commercial posts, piling, mine timbers, particleboard bolts, and cabin logs (table 2).

Output is shifting from softwoods to hardwoods. Softwoods constitute one-third of the volume in 1954

Table 1. — *Industrial roundwood production in Michigan, 1954, 1965, 1969*
(Million cubic feet)

Product	All Species			Softwoods			Hardwoods		
	1954	1965	1969	1954	1965	1969	1954	1965	1969
Pulpwood	61.7	103.8	93.2	28.6	33.9	28.0	33.1	69.9	65.3
Saw logs	62.6	57.2	62.9	15.7	5.7	7.4	46.9	51.5	55.5
Veneer logs	5.3	3.0	2.6	*	*	*	5.3	3.0	2.6
Poles & piling	.4	.2	.2	.2	.1	.1	.2	.1	.1
Mine timbers	3.7	1.2	1.0	2.5	1.1	1.0	1.2	.2	*
Posts[1]	2.8	3.6	3.0	2.8	3.6	3.0	--	--	--
Misc.	13.3	6.8	10.9	.6	.8	2.5	12.7	6.0	8.4
Total	149.8	175.8	173.8	50.4	45.2	42.0	99.4	130.7	131.8

* Less than 50 thousand cubic feet.
[1] Includes only posts processed at fence and treating plants.

Table 2. — *Volume of industrial roundwood production in Michigan, 1969*

Product	Standard units	Thousand standard units: All species	Thousand standard units: Softwoods	Thousand standard units: Hardwoods	Thousand cubic feet: All species	Thousand cubic feet: Softwoods	Thousand cubic feet: Hardwoods
Pulpwood	Standard cords	1,180	355	825	93,222	28,055	65,167
Sawlogs	Board feet 1/	426,068	51,181	374,887	62,930	7,418	55,512
Veneer logs	Board feet 1/	19,194	8	19,186	2,625	1	2,624
Piling	Linear feet	124	20	104	87	8	79
Poles	Pieces	8	8	--	68	68	--
Mine timbers	Cubic feet	980	955	25	980	955	25
Posts 2/	Pieces	2,918	2,918	--	3,000	3,000	--
Misc. 3/	Cubic feet	10,905	2,497	8,408	10,905	2,497	8,408
Total	--	--	--	--	173,817	42,002	131,815

1/ International 1/4-inch rule.
2/ Includes only posts processed at fence and treating plants.
3/ Includes cabin logs, shingle bolts, and particleboard bolts.

but slightly less than one-quarter in 1969. Technological changes in pulping processes allow large quantities of hardwoods to be pulped that were formerly unusable.

The number of active primary wood-using mills[1] declined rapidly from 1954 to 1969 (table 3). Meanwhile, wood receipts at these mills rose 14 percent (table 4). Decline in the number of mills is likely to continue but at a slower rate.

Table 3. — *Number of active primary wood-using plants in Michigan, 1954, 1965, and 1969*

Kind of plant 1/	1954	1965	1969
Pulpmills	11	10	9
Sawmills,			
Large 2/	11	15	17
Medium 3/	85	107	103
Small 4/	1,296	266	187
Total	1,392	388	307
Veneer mills			
Face, core & speciality	4	4	6 5/
Container	19	8	6
Total	23	12	12
Charcoal	2	1	--
Misc.	102	26	19 6/
Grand Total	1,530	437	347

1/ Number of active small sawmills estimated for 1954.
2/ Annual lumber production in excess of 5 million board feet.
3/ Annual lumber production from 1 million to 5 million board feet.
4/ Annual lumber production less than 1 million board feet.
5/ One mill classified as a container veneer mill in 1965 is now classified as a specialty veneer mill.
6/ Includes 1 shingle mill, 3 log cabin plants, 1 particleboard plant, 2 treating plants, and 12 fence plants.

Primary plants are widely dispersed in the State (fig. 1). However, the larger mills tend to be concentrated in the north half of the Lower Peninsula and the Upper Peninsula near the largest timber supplies.

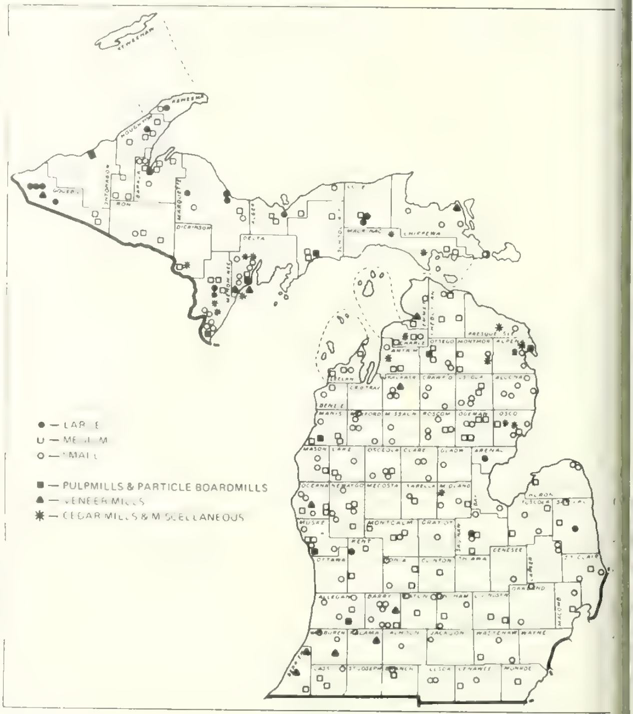
● — LARGE
□ — MEDIUM
○ — SMALL
■ — PULPMILLS & PARTICLE BOARDMILLS
▲ — VENEER MILLS
✱ — CEDAR MILLS & MISCELLANEOUS

Figure 1. — *Primary wood-using plants in Michigan, 1969. Sawmills are classed by volume of lumber produced in 1969: large = 5 million board feet or more; medium = 1 to 4.999 million board feet; small = 100 to 999 thousand board feet. (Smaller sawmills not shown.)*

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[1] *Mills receiving roundwood or chips from roundwood are primary mills.*

Table 4. — *Major industrial roundwood receipts by type of plant in Michigan, 1954, 1965, 1969*
(Million cubic feet)

Type of plant	All species			Softwoods			Hardwoods		
	1954	1965	1969	1954	1965	1969	1954	1965	1969
Pulpmills	32.3	65.2	54.1	14.5	17.7	12.1	17.8	47.5	42.0
Sawmills	70.3	57.4	62.3	16.5	5.7	7.8	53.8	51.7	54.5
Veneer mills	4.3	1.7	2.0	.1	*	--	4.2	1.7	2.0
Other mills1/	8.8	10.8	13.7	3.5	4.9	5.3	5.3	5.9	8.4
Total	115.7	135.1	132.1	34.6	28.3	25.2	81.1	106.8	106.9

* Less than 50 thousand cubic feet
1/ Does not include treating plants

Almost half of Michigan's industrial roundwood was cut in the Upper Peninsula (fig. 2). However, the proportion supplied by the Upper Peninsula has declined since 1954. Leading industrial roundwood producing counties, in descending order of volume, are Marquette, Menominee, Baraga, Iron, Lake, Luce, Delta, and Gogebic.

Although log and bolt shipments out-of-State are substantially larger than imports, the proportion of the harvest used internally is increasing.

PULPWOOD — HARDWOODS AND PLANT BYPRODUCTS BECOMING MORE IMPORTANT SOURCES

Michigan pulpwood cutting is shifting from softwoods to hardwoods (fig. 3). During the late 40's the hardwood-to-softwood cut ratio was 0.4 to 1; since 1965 the ratio has been 2.1 to 1. Volumewise, aspen is the most important pulpwood species followed by pine and mixed hardwoods[2]. During the last 23 years, mixed hardwood production has increased at the greatest rate[2].

Except for aspen, oak is the dominant hardwood pulpwood species cut in the Lower Peninsula. Pulpwood is an important outlet in the Lower Peninsula for scrub oak.

Pine pulpwood harvesting has climbed irregularly since 1946, with the greatest increase from 1955 to 1959 (fig. 4). At the same time, cutting of other softwoods, primarily spruce, balsam fir, and hemlock, fell sporadically. Overall, softwood pulpwood harvests have been erratic, ranging from about 300,000 to 600,000 cords annually since 1946.

Michigan sawmill and veneer mill byproducts (such as slabs, edgings, and veneer cores) have become an important pulpwood source in the last 4 or 5 years. Their use is likely to expand as average sawmill size increases, debarkers and chippers are installed, and wood waste disposal regulations become stricter.

Pulpwood output in Michigan has been increasing at more than 3.5 percent annually during the last two decades. This rate of increase will probably be larger during the next 3 or 4 years. However, the trend during the last two decades has been for a larger share of the pulpwood to be used in Michigan, while the annual volume shipped to Wisconsin has been erratic with no clear trend up or down.

Annual pulpwood production was the fifth largest in 1969, 17 percent below the peak in 1966. More than two-fifths of the pulpwood was shipped to Wisconsin mills; nearly half of this was aspen (table 5). These shipments, all from the Upper Peninsula, represented over one-fifth of Wisconsin's pulpwood requirements.

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[2] *Mixed hardwoods include oak.*

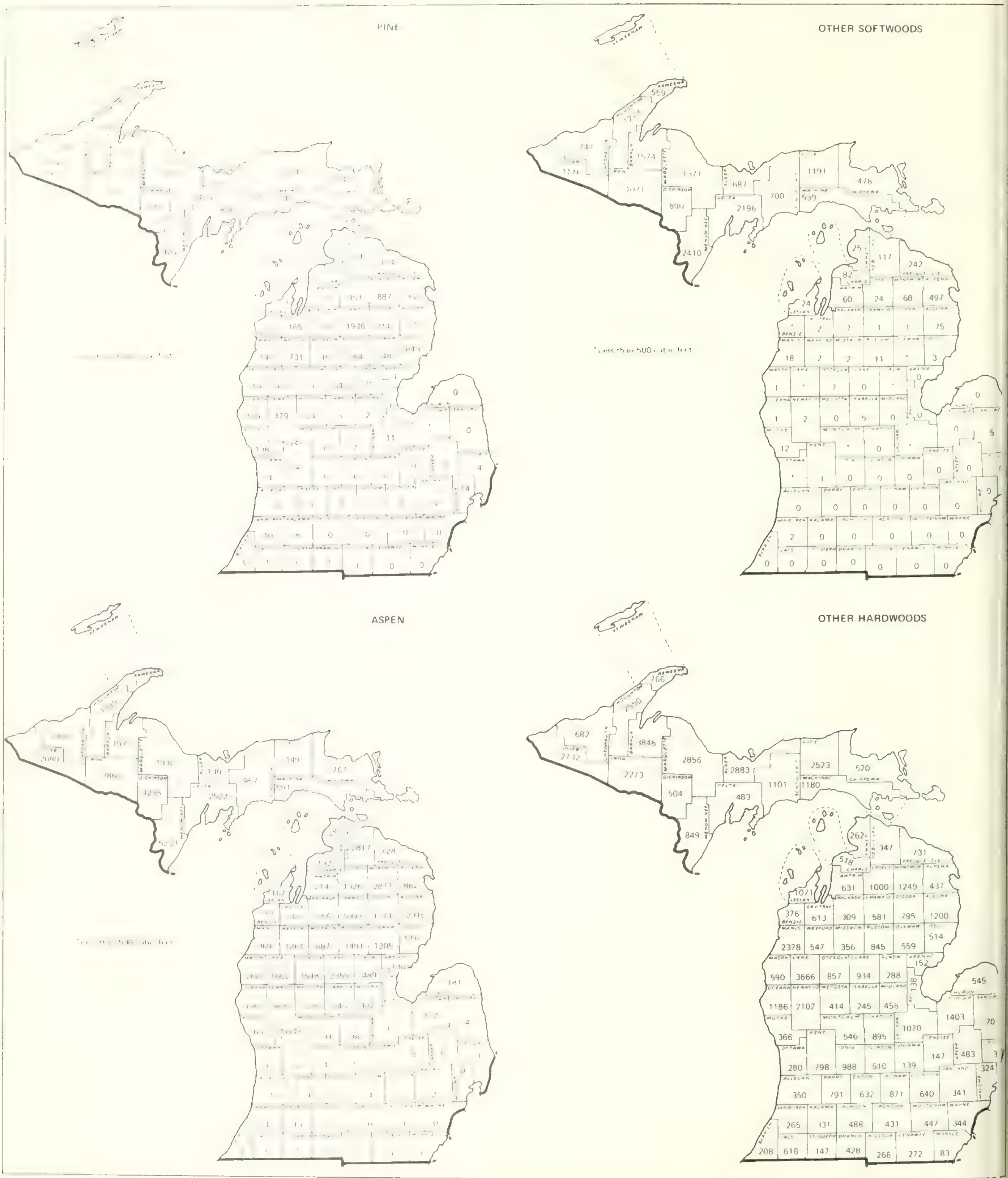

Figure 2. — *Industrial roundwood output by species and county in Michigan, 1969, in thousand cubic feet. (Does not include poles, piling, or mine timbers.)*

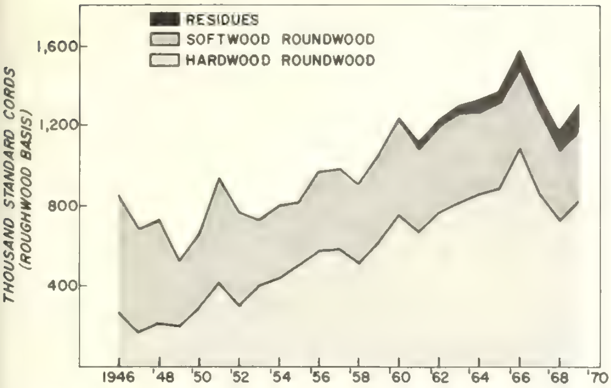

Figure 3. — *Pulpwood production trends in Michigan, 1946-1969.*

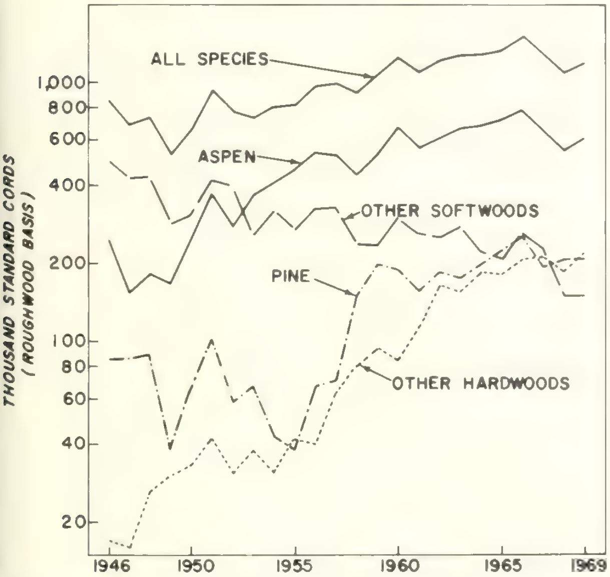

Figure 4. — *Round pulpwood production by species groups in Michigan, 1946-1969.*

Table 5. — *Michigan pulpwood production by species groups and destination, 1969*
(Thousand standard cords, roughwood basis)

Species	Destination of wood			Total
	Michigan	Wisconsin	Other States and Canada	
Roundwood:[1/]				
Pine	116	91	--	207
Spruce	15	23	1	39
Balsam fir	19	24	1	44
Hemlock	2	61		63
Tamarack	--	2	--	2
Aspen	355	250	1	606
Oak [2/]	80	-		80
Birch	22	1	--	[illegible]
Other hardwoods [3/]	71	44	1	116
Total	680	496	4	1,180
Residues:				
Softwoods	--	5	[illegible]	8
Hardwoods	72	36	6	114
All material	752	537	13	1,302

1/ Includes chips from roundwoods.
2/ Excludes a small quantity of oak from the Upper Peninsula.
3/ Includes small quantity of oak from the Upper Peninsula.

Many companies buy pulpwood in the Upper Peninsula. Except for Keweenaw, each Upper Peninsula county furnished pulpwood for 10 or more plants in 1969 (fig. 5). Sixteen Wisconsin plants received pulpwood from this area.

Figure 5. — *Number of plants receiving pulpwood from Upper Michigan Counties, 1969.*

Fifty-seven counties contributed to the 1969 pulpwood harvest (table 6). Counties furnishing more than 60,000 cords of pulpwood that year were Delta, Dickinson, Iron, Lake, Marquette, and Menominee.

Nine Michigan plants received 771 thousand cords of pulpwood in 1969; all but 19 thousand cords were from Michigan (table 7). Nearly half was aspen, 15 percent was pine, and 11 percent was byproducts from other primary wood-using mills.

Use of aspen, oak, and other hardwoods in Michigan has increased sharply in the last 20 years (table 8). Pine receipts dipped to a postwar low of 20 thousand cords in 1955 but have rebounded to 100 thousand cords or more annually since 1964. Spruce and other softwoods have declined in importance because some mills that used these species in the past are no longer operating.

A recent Michigan mill closing has nearly eliminated Canada as a source of pulpwood. By contrast, Canada supplied about one-third of Michigan's needs in 1948 and over 10 percent in 1967 (table 9).

Table 6.—*Pulpwood production from roundwood by county and species groups in Michigan, 1969*
(Thousand standard cords, roughwood basis)

County	Pine	Spruce	Balsam Fir	Hemlock	Tamarack	Aspen	Oak	Birch	Other hardwoods	All species
Alcona	1	--	*	--	--	35	7	2	4	49
Alger	7	1	1	1	--	2	1/	--	1	13
Allegan	--	--	--	--	--	*	1	--	*	1
Alpena	1	*	*	--	--	9	1	1	2	14
Antrim	--	--	--	--	--	2	*	*	*	2
Arenac	*	--	--	--	--	*	*	*	*	*
Baraga	6	1	*	11	*	23	1/	1	12	54
Benzie	*	--	--	--	--	9	1	1	1	12
Cheboygan	1	*	*	--	--	13	*	2	2	18
Chippewa	9	2	*	1	1	6	1/	*	2	21
Clare	3	--	--	--	--	25	3	2	4	37
Crawford	21	--	--	--	--	9	1	1	1	33
Delta	11	7	9	3	*	31	1/	*	2	63
Dickinson	2	5	2	2	1	52	1/	--	*	64
Gladwin	*	--	--	--	--	4	*	*	1	5
Gogebic	2	*	1	11	*	11	1/	*	8	33
Grand Traverse	2	--	--	--	--	10	3	1	*	16
Houghton	2	2	1	12	*	11	1/	*	2	30
Huron	--	--	--	--	--	2	--	--	--	2
Iosco	10	--	--	--	--	3	1	*	1	15
Iron	2	2	4	6	*	48	1/	--	14	76
Isabella	--	--	--	--	--	3	*	*	*	3
Kalamazoo	*	--	--	--	--	*	*	--	*	*
Kalkaska	3	--	--	--	--	9	1	*	1	14
Kent	*	--	--	--	--	--	--	--	--	*
Keweenaw	--	2	2	--	*	--	1/	--	--	4
Lake	12	--	--	--	--	20	25	1	11	69
Leelanau	--	--	--	--	--	1	--	*	--	1
Luce	17	3	3	2	*	2	1/	--	1	28
Mackinac	2	1	2	*	--	1	1/	*	1	7
Manistee	1	--	--	*	--	12	11	1	11	36
Marquette	24	6	4	3	*	23	1/	--	1	61
Mason	2	--	--	--	--	2	2	*	*	6
Mecosta	*	--	--	--	--	15	1	*	3	19
Menominee	*	4	9	2	*	65	1/	1	2	83
Midland	*	--	--	--	--	5	*	*	*	5
Missaukee	1	--	--	--	--	8	1	*	1	11
Montcalm	*	--	--	--	--	4	2	*	2	8
Montmorency	7	1	*	--	--	18	5	2	2	35
Muskegon	1	--	--	--	--	1	--	--	2	4
Newaygo	2	--	--	--	--	9	4	*	6	21
Oceana	2	--	--	--	--	2	2	*	1	7
Ogemaw	3	--	--	--	--	3	*	*	1	7
Ontonagon	*	*	2	7	--	16	1/	--	1	26
Osceola	*	--	--	--	--	18	3	*	2	23
Oscoda	23	*	*	--	--	15	1	2	2	43
Otsego	2	--	--	--	--	*	--	--	--	2
Ottawa	*	--	--	--	--	*	--	--	*	*
Presque Isle	*	*	1	--	--	7	1	2	3	14
Roscommon	3	*	*	--	--	14	2	2	2	23
Saginaw	*	--	--	--	--	--	--	--	--	*
St. Joseph	--	--	--	--	--	*	*	--	*	*
Sanilac	--	--	--	--	--	*	--	--	--	*
Schoolcraft	13	2	3	2	*	12	1/	*	1	33
Tuscola	--	--	--	--	--	*	--	--	--	*
Van Buren	--	--	--	--	--	--	*	--	*	*
Wexford	9	--	--	--	--	16	1	1	2	29
Total	207	39	44	63	2	606	80	23	116	1,180

*Less than 500 cords.

1/ Oak is shown with other hardwoods in Upper Peninsula counties--the volume is not significant.

Table 7. — *Pulpwood receipts in Michigan by species groups and area of origin, 1969*
(Thousand standard cords, roughwood basis)

Species groups	Area of origin				
	Michigan	Wisconsin	Other States	Canada	Total
Roundwood1/					
Pine	116	-	--	-	116
Spruce	15	-	-	1	16
Balsam fir	19	--	--	--	19
Hemlock	2	--	--	--	--
Tamarack	--	--	--	--	--
Aspen	356	2	--	--	358
Oak	80	-	--	--	80
Birch	22	--	--	--	22
Other hardwoods	71	--	--	1	72
Total	681	2	--	2	685
Residues:					
Softwoods	--	-	--	--	--
Hardwoods	71	6	9	--	86
All material	752	8	9	2	771

1/ Includes chips from roundwood.

Table 8. — *Pulpwood receipts in Michigan for selected years, 1946-1969*
(Thousand standard cords, roughwood basis)

Year	Roundwood						Hard-[illegible]	Total
	Pine	[illegible]	Other [illegible]	Aspen	[illegible]1/	[illegible]		
1946	85	133	121	69	-	8		[illegible]
1953	75	101	100	142	-	33		451
1960	128	94	87	431	11	59	--	810
1961	109	75	68	[illegible]	39	58		700
1962	[illegible]	[illegible]	35	387	41	[illegible]		[illegible]
1963	84	79	49	398	[illegible]	86		[illegible]
1964	107	[illegible]	[illegible]	[illegible]	49	96		[illegible]
1965	[illegible]	71	39	[illegible]	[illegible]	91	18	825
1966	143	78	49	526	61	106	41	1,004
1967	117	81	48	323	85	[illegible]	38	774
1968	133	61	[illegible]	328	[illegible]	99	56	[illegible]
1969	116	16	21	[illegible]	79	94	87	771

1/ [illegible] receipts [illegible] hardwoods--the volume is not significant.

Table 9. — *Pulpwood receipts in Michigan by area of origin, roundwood and residues, 1946-1969*
(Thousand standard cords, roughwood basis)

Year	Roundwood					Residues			Total
	Area of origin					Area of origin			
	Mich.	Wis.	Minn	Other states	Canada	Mich.	Wis.	Other states	
1946	259	--	12	--	145	--	--	--	416
1947	239	42	21	--	142	--	--	--	444
1948	270	--	22	1	191	1	--	--	485
1949	130	--	3	*	125	--	--	--	258
1950	258	--	3	--	122	--	--	--	383
1951	398	4	9	1	170	--	--	--	582
1952	290	5	1	2	151	--	--	--	449
1953	319	11	11	*	110	--	--	--	451
1954	309	*	4	*	99	--	--	--	412
1955	356	--	5	--	94	--	--	--	455
1956	437	--	7	--	91	--	--	--	535
1957	427	--	9	--	97	--	--	--	533
1958	458	--	7	--	84	--	--	--	549
1959	602	3	7	--	86	1	--	--	699
1960	727	*	*	--	83	--	--	--	810
1961	628	1	--	--	71	--	--	--	700
1962	677	1	1	--	--	--	--	--	679
1963	669	2	--	--	71	--	--	--	742
1964	728	1	--	--	59	3	--	--	791
1965	732	1	--	--	74	18	--	--	825
1966	862	3	*	1	97	40	--	1	1,004
1967	651	*	*	*	85	34	--	4	774
1968	653	3	*	*	62	49	1	6	774
1969	681	2	--	--	2	71	6	9	771

* Less than 500 cords

SAW LOG PRODUCTION STABILIZED — AVERAGE SAWMILL SIZE INCREASING

Saw log production in 1969 was little changed from 1954. Nearly 88 percent of the harvest in 1969 was hardwoods. Principal hardwood species cut are hard maple, red oak, aspen, and soft maple (table 10). Leading softwoods are white pine, hemlock and red pine.

Counties each furnishing more than 20 million board feet of saw logs in 1969 were Baraga, Marquette, Luce, Gogebic, and Alger, all in the Upper Peninsula. Top-producing counties for individual species were as follows (table 11): Baraga-hard maple, yellow birch, and hemlock; Newaygo-red oak and white oak; Gogebic-aspen and basswood; Saginaw-soft maple; Antrim-elm; Alger-beech; and Marquette-white pine.

Only 8 million board feet of saw logs were shipped out-of-State, primarily to Wisconsin. More than half the volume shipped to Wisconsin was aspen.

Michigan sawmills received 418 million board feet of saw logs in 1969 (table 12), of which less than 1 million board feet came from out-of-State.

Average lumber output per sawmill is increasing because some small mills are closing, some of the larger mills are increasing their efficiency, and most new mills are larger than the average. Output per mill in 1969 was five times greater than in 1954 and 30 percent greater than in 1965 (fig. 6).

Large sawmills, although few in number, are important contributors to total production. Seventeen large mills, each cutting more than 5 million board feet annually, produced 35 percent of Michigan's lumber in 1969 (fig. 7). On the other hand, 187 small mills, each producing less than 1 million board feet

Table 10. — *Michigan saw log production by species and state of destination, 1969*

(Thousand board feet, International ¼-inch rule)

Species	Michigan	Wisconsin	Indiana	Ohio	Other states	Total
White pine	19,991	937	--	--	--	20,928
Red pine	5,629	58	--	--	--	5,687
Jack pine	1,535	40	--	--	--	1,575
Spruce	568	99	--	--	--	667
Balsam fir	83	95	--	--	--	178
Hemlock	19,063	97	--	—	--	19,160
Tamarack	5	--	--	--	--	5
No. White-cedar	2,980	1	—	--	--	2,981
All Softwoods	49,854	1,327	—	—	--	51,181
White oak	19,580	--	44	—	9	19,633
Red oak	49,793	60	11	--	--	49,864
Yellow birch	20,271	462	--	—	--	20,733
Hard maple	105,683	1,034	100	35	13	106,865
Soft maple	30,948	134	3	12	--	31,097
Beech	22,258	29	19	4	--	22,310
Ash	10,138	14	--	--	7	10,159
Cottonwood	9,618	--	6	6	--	9,630
Aspen	38,483	4,655	--	--	--	43,138
Basswood	16,757	104	5	6	--	16,872
Yellow-poplar	493	--	--	--	--	493
Black walnut	547	--	62	--	--	609
Black cherry	2,389	11	--	--	--	2,400
Elm	28,891	124	--	--	--	29,015
Paper birch	4,983	129	--	--	--	5,112
Other hardwoods	6,954	--	1	--	2	6,957
All hardwoods	367,786	6,756	251	63	31	374,887
All species	417,640	8,083	251	63	31	426,068

Table 11.—*Saw log production by county and species groups in Michigan, 1969*
(Thousand board feet, International ¼-inch rule)

County	White pine	Red & Jack pine	Hemlock	Other softwoods	White oak	Red oak	Yellow birch	Hard maple	Soft maple	Beech	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alcona	33	219	--	19	13	365	50	[illegible]	[illegible]	5	[illegible]	[illegible]		[illegible]	2,169
Alger	1,444	60	2,522	5	--	49	1,745	8,758	[illegible]	5,141	[illegible]	73	169	[illegible]	21,565
Allegan	--	--	--	--	218	297	[illegible]	379	294	[illegible]	26	[illegible]	5	[illegible]	1,839
Alpena	4	22	--	[illegible]	1	150	--	[illegible]	[illegible]	2	[illegible]	--	301	[illegible]	922
Antrim	18	21	56	2	--	30	[illegible]	843	[illegible]		438	759	1,574	282	4,395
Arenac	--	15	--	--	46	[illegible]	--	30	105	15	586	15		[illegible]	1,634
Baraga	1,980	50	3,648	328	--	299	4,679	11,868	580	--	1,205	391	1,002	181	26,211
Barry	--	--	--	--	292	2,346	--	1,131	682	188	36	165	--	529	5,397
Bay	--	--	--	--	56	93	--	43	221	7	1	26	42	458	947
Benzie	--	--	3	--	12	113	--	144	2	[illegible]	73	140	404	111	[illegible]
Berrieu	--	--	--	--	150	380	--	160	190	50		90		190	1,210
Branch	--	--	--	--	369	661	--	551	503	[illegible]		153		368	2,761
Calhoun	--	--	--	--	470	1,112	--	345	582	190		159	20	442	3,320
Cass	--	--	--	--	606	1,244	--	467	410	270		247	10	705	3,959
Charlevoix	1	11	17	--	--	22	17	1,076	124	264	1,092	649	1,113	182	[illegible]
Cheboygan	32	76	15	15	--	280	8	388	164	145	2,991	177	867	592	5,750
Chippewa	687	335	55	267	--	5	[illegible]	711	92	241	287	74	86	66	3,045
Clare	--	--	--	--	11	140	--	15	90	3	501	30	266	38	1,094
Clinton	--	--	--	--	318	690	--	862	528	190	7	148	39	691	3,473
Crawford	89	338	4	2	50	426	5	[illegible]	110	5	870	75	425	37	2,481
Delta	601	304	135	322	--	6	217	550	264	180	260	37	278	322	3,476
Dickinson	272	23	463	56	--	8	181	1,363	120	88	701	620	415	388	4,698
Eaton	--	--	--	--	195	681	--	1,463	407	458	13	302	72	515	4,106
Emmet	3	--	19	--	25	21	24	414	24	307	340	91	389	137	1,794
Genesee	--	--	--	--	110	168	--	[illegible]	194	[illegible]	--	42	51	121	980
Gladwin	--	22	--	1	5	191	--	7	175	4	419	15	378	469	1,686
Gogebic	380	190	1,093	168	--	59	2,172	8,791	459	--	6,172	1,068	947	295	21,794
Grand Traverse	9	2	12	--	1	44	15	454	[illegible]	404	73	169	483	161	1,831
Gratiot	13	--	--	--	776	1,157	--	1,123	[illegible]	475	218	449	72	1,081	6,353
Hillsdale	--	4	--	--	177	282	629	150	88	67	--	90	13	119	1,619
Houghton	338	112	269	244	--	884	2,431	9,091	1,300	--	1,171	471	326	161	16,798
Huron	--	--	--	--	90	120	--	587	1,115	20	128	311	327	1,174	3,872
Ingham	--	--	--	--	637	1,563	--	877	1,102	219	22	384	75	958	5,837
Ionia	--	--	--	--	708	1,651	--	980	1,000	[illegible]	[illegible]	[illegible]	179	1,356	6,786
Iosco	91	93	--	5	269	373	--	60	231	30	1,493	[illegible]	770	824	4,362
Iron	1,125	114	482	74	--	56	1,208	4,671	330	[illegible]	503	541	608	276	9,990
Isabella	21	--	8	--	62	167	1	128	248	66	509	347	412	200	2,169
Jackson	--	--	--	--	404	652	398	362	431	155	--	95	13	318	2,828
Kalamazoo	--	--	--	--	182	576	--	408	333	109	72	98	92	283	2,153
Kalkaska	195	114	34	5	--	157	6	168	42	62	213	86	370	27	1,479
Kent	31	1	16	--	355	1,612	1	1,339	633	380	71	359	32	749	5,579
Keweenaw	930	--	1,700	214	60	70	1,018	3,300	200	--	450	150	250	70	8,412
Lake	90	40	3	--	822	2,577	--	230	323	142	217	136	693	164	5,437
Lapeer	--	--	--	--	616	494	--	714	452	89	--	115	61	775	3,316
Leelanau	3	2	135	15	36	[illegible]	8	1,837	75	1,919	382	859	1,178	579	7,855
Lenawee	--	--	--	--	411	634	--	203	[illegible]	22	--	84	43	187	1,826
Livingston	--	--	--	--	1,026	896	--	996	485	116	--	[illegible]	38	585	4,299
Luce	3,002	2,510	2,891	40	--	4	1,514	8,078	1,294	3,064	[illegible]	193	763	1,369	24,751
Mackinac	468	121	241	537	--	--	242	3,664	433	513	1,173	101	349	352	8,194
Macomb	16	--	--	--	79	67	--	10	55	--	--	[illegible]	24	[illegible]	275
Manistee	73	54	44	--	410	954	2	582	380	351	251	[illegible]	791	331	4,398
Marquette	5,768	334	1,723	68	50	531	2,331	10,211	1,236	1,036	747	838	[illegible]	577	26,038
Mason	18	6	4	--	201	788	2	371	455	[illegible]	235	144	287	126	2,769
Mecosta	26	--	--	--	172	349	--	40			70	27	73	79	896
Menominee	1,128	76	2,858	1,134	--	48	346	2,396	202	100	789	[illegible]	447	414	10,292
Midland	--	--	--	--	135	260	--	215	885	40	125	44	135	1,346	3,185
Missaukee	17	19	4	11	12	270	5	134	8	23	267	72	647	26	1,515
Monroe	--	--	--	--	16	536	--	--	10	--	--	--			567
Montcalm	41	--	1	--	350	1,234	3	303	510	78	446	487	43	740	4,236
Montmorecy	110	110	1	--	25	129	--	83	100	11	1,331	61	231	87	2,279
Muskegon	103	1	74	--	214	707	7	59	147	59	50	17	29	60	1,527
Newaygo	195	1	10	--	1,306	4,559	2	417	584	66	1,010	[illegible]	1,169	[illegible]	9,728
Oakland	--	--	--	--	613	564	--	485	278	58	12	72	21	251	2,354
Oceana	174	--	4	--	1,053	2,499	2	613	467	120	95	213	1,203	104	6,547
Ogemaw	20	54	--	3	97	954	2	31	130	33	4,376	49	893	680	7,322
Ontonagon	136	87	360	94	--	39	616	2,577	224	--	2,970	212	181	[illegible]	7,626
Osceola	23	17	42	--	425	643	17	300	121	153	760	146	1,077	181	3,905
Oscoda	182	528	--	9	102	994	--	9	93	3	2,463	12	542	311	5,248
Otsego	95	96	15	2	25	31	14	[illegible]	80	[illegible]	[illegible]	[illegible]	847	185	3,308
Ottawa	1	--	1	--	273	580	1	[illegible]	236	113	28	88	29	[illegible]	1,907
Presque Isle	48	25	--	85	--	196	--	36	--	9	810	2	[illegible]	277	1,835
Roscommon	63	210	--	5	--	1,368	--	31	25	20	798	27	[illegible]	108	3,120
Saginaw	41	--	1	--	1,174	1,446	--	[illegible]	1,473	[illegible]	4	427	[illegible]	1,607	7,386
St. Clair	26	--	--	--	350	458	4	449	393	111	7	85	[illegible]		2,390
St. Joseph	--	--	--	--	92	210	--	140	140	52		55	[illegible]	[illegible]	[illegible]
Sanilac	--	--	30	--	511	711	13	689	1,198	[illegible]	14	[illegible]	[illegible]	[illegible]	4,749
Schoolcraft	694	838	144	18	--	[illegible]	589	2,450	412	1,493	60	35	211	695	7,643
Shiawassee	--	--	--	--	129	207	--	214	173	30	--	[illegible]	22	127	958
Tuscola	2	--	--	--	1,022	1,623	--	1,113	1,114	365	991	[illegible]	427	3,451	10,575
Van Buren	64	--	10	--	135	216	--	200	216	85	24	72		[illegible]	[illegible]
Washtenaw	--	--	--	--	681	914	--	358	380	86	7	105	18	348	2,897
Wayne	--	--	--	--	321	682	--	335	247	45	--	49	416	[illegible]	2,265
Wexford	4	7	13	1	81	258	9	196	148	92	158	[illegible]	618	158	1,877
Total	20,928	7,262	19,160	3,831	19,633	49,864	20,733	106,865	31,097	22,310	43,138	16,872	[illegible]	[illegible]	[illegible]

Table 12. —*Saw log receipts in Michigan by species and State of origin, 1969*
(Thousand board feet, International ¼-inch rule)

Species	Michigan	Wisconsin	Indiana	Total
White pine	19,991	-	--	19,991
Red pine	5,629	--	--	5,629
Jack pine	1,535	--	--	1,535
Spruce	568	--	--	568
Balsam fir	83	--	—	83
Hemlock	19,063	227	--	19,290
Tamarack	5	--	--	5
No. white-cedar	2,980	--	--	2,980
All softwoods	49,854	227	--	50,081
White oak	19,580	--	50	19,630
Red oak	49,793	--	70	49,863
Yellow birch	20,271	2	--	20,273
Hard maple	105,683	17	60	105,760
Soft maple	30,948	--	50	30,998
Beech	22,258	--	40	22,298
Ash	10,138	--	20	10,158
Cottonwood	9,618	—	30	9,648
Aspen	38,483	--	--	38,483
Basswood	16,757	--	40	16,797
Yellow-poplar	493	--	--	493
Black walnut	547	--	10	557
Black cherry	2,389	--	10	2,399
Elm	28,891	--	—	28,891
Paper birch	4,983	--	--	4,983
Other hardwoods	6,954	--	20	6,974
All hardwoods	367,786	19	400	368,205
All species	417,640	246	400	418,286

annually, accounted for only 14 percent of the 1969 lumber output. Medium-size mills produced the remainder.

Lumber production peaked at about 5.5 billion board feet in 1889, declined to a record low of 160 million board feet in 1932, rebounded to a postwar high of 595 million board feet in 1946, and oscillated between 595 and 273 million board feet since then (fig. 8).

Since 1954 the number of active sawmills has declined rapidly. An estimated 1,392 mills were active in 1954 compared with 388 in 1965 and 307 in 1969. By contrast, the number of large sawmills has increased from 11 in 1954 to 17 in 1969. During these 15 years medium sawmills (1 to 5 million feet annually) have increased by 18.

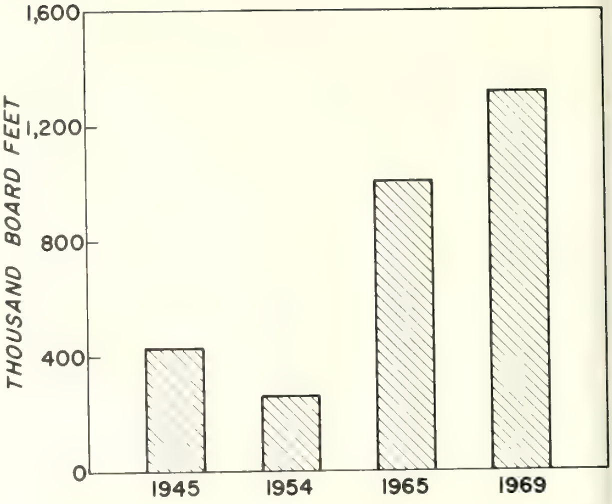

Figure 6. —*Average output per sawmill in Michigan.*

VEENER INDUSTRY ON A PLATEAU

Veneer log production dropped sharply from 1946 to 1958 but has been steady since then (fig. 9). Only one-fourth as much volume is harvested now as in 1946. Twenty years ago container mills were the greatest single user of veneer logs. Today container veneer logs constitute only one-seventh of the total veneer log output.

The container veneer industry had severe setbacks during the period of 1946-1958 as plastic and paperboard containers were substituted for veneer. Since then the industry has stabilized at a low output level.

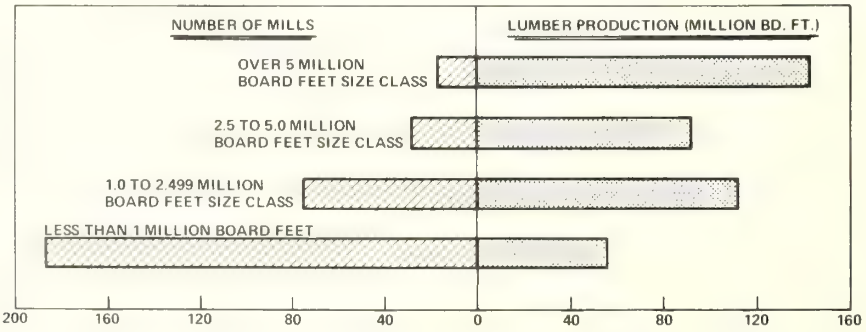

Figure 7. —*Lumber production and number of sawmills by annual production size class in Michigan, 1969.*

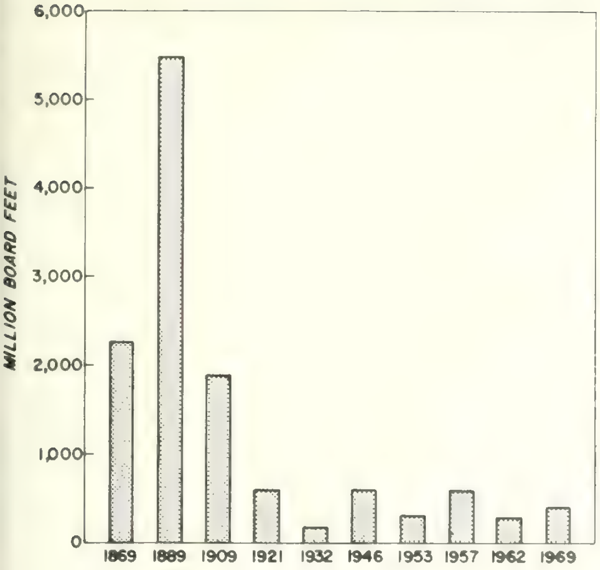

Figure 8. — *Lumber production in Michigan for selected years, 1869-1969. Sources: Lumber production in the United States 1799-1946, U.S. Dep. Agr. Misc. Public. 669, 1948; Lumber production and mill stocks, Annu. Rep. U.S Dep. Com. Bur. Census, Annu. Reports: 1953, 1957, 1962 and 1969.*

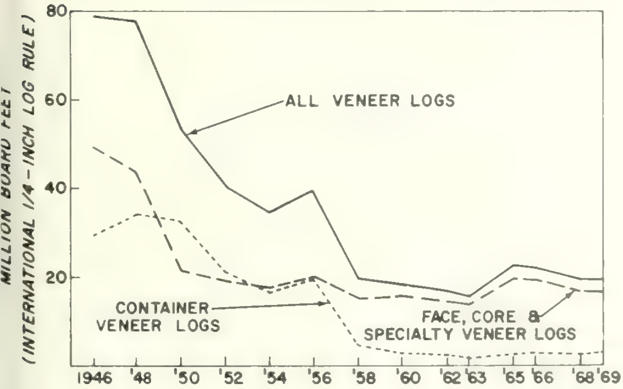

Figure 9. — *Veneer log production in Michigan for selected years, 1946-1969.*

Only six container veneer mills operated in 1969 compared with 19 in 1946.

Other types of veneer log output have followed a similar pattern of decline and stabilization. Face veneers are meeting stiff competition from plastic substitutes with wood grain finishes.

Elm, birch, and maple veneer log harvesting has declined greatly since 1946 (fig. 10). On the other hand, aspen veneer log production has recently increased significantly. A promising new use for aspen is in construction grade plywood. If this aspen product finds a ready market, aspen veneer log production will rise substantially.

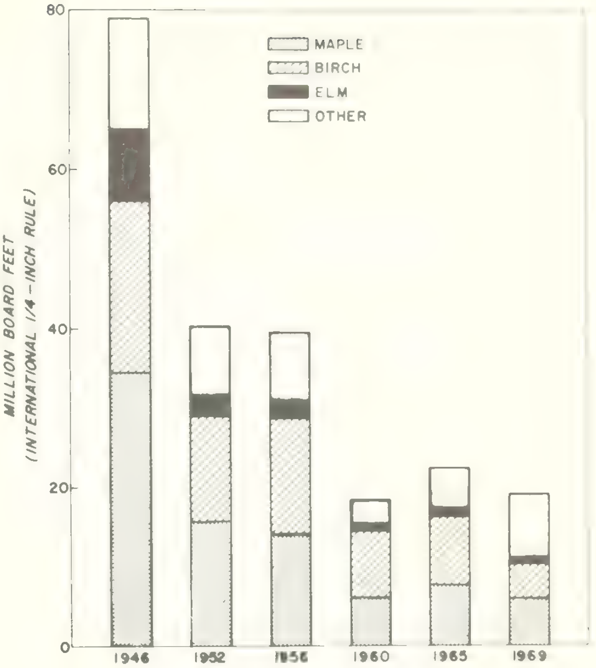

Figure 10. — *Veneer log production in Michigan for selected years, 1946-1969.*

Michigan is a net exporter of veneer logs. Wisconsin mills purchased 23 percent of the 19.2 million board feet of veneer logs cut in Michigan in 1969 (table 13). However, all container veneer logs were consumed in Michigan. Hard maple and yellow birch are important veneer species.

Only 2.3 million board feet of logs received at Michigan veneer mills in 1969 were from out-of-State; Wisconsin furnished two-thirds of them, Minnesota, Indiana, and Canada the remainder (table 14). Log receipts in the State were the largest on record since 1956 but only one-third of the 1946 total (fig. 11).

OTHER INDUSTRIES DIVERSE AND CHANGING

Other industrial roundwood products produced in Michigan in 1969 were poles, piling, mine timbers, shingle bolts, commercial posts, particleboard bolts, and cabin logs. Excluding mine timbers, 19 Michigan plants received 14 million cubic feet of these products

Table 13. — *Michigan veneer log and bolt production by species and State or country of destination, 1969*

(Thousand board feet, International ¼-inch rule)

Species	Destination							Total
	Michigan	Wisconsin	Indiana	Ohio	Kentucky	Canada	Other countries	
White pine	--	8	--	--	--	--	--	8
White oak	42	—	22	--	28	45	--	137
Red oak	200	574	173	--	143	145	8	1,243
Yellow birch	2,434	834	--	--	--	--	--	3,268
Hard maple	2,020	2,757	605	184	111	--	37	5,714
Soft maple	302	65	--	--	--	--	--	367
Beech	457	4	--	--	--	--	--	461
Ash	279	8	--	--	--	2	--	289
Cottonwood	518	--	--	--	--	--	--	518
Aspen	4,014	--	--	--	--	--	--	4,014
Basswood	211	198	23	--	--	--	--	432
Yellow-poplar	24	--	--	--	--	--	--	24
Black walnut	--	--	184	--	34	15	117	350
Black cherry	257	1	19	--	--	8	8	293
Elm	767	45	24	--	--	--	55	891
Paper birch	902	25	--	--	--	--	--	927
Other hardwoods	236	--	21	--	--	1	--	258
All species	12,663	4,519	1,071	184	316	216	225	19,194

Table 14. — *Veneer log and bolt receipts in Michigan by species and State or country of origin, 1969*

(Thousand board feet, International ¼-inch rule)

Species	Michigan	Wisconsin	Minnesota	Indiana	Canada	Total
White oak	42	--	--	--	--	42
Red oak	200	--	--	--	--	200
Yellow birch	2,434	--	--	--	--	2,434
Hard maple	2,020	200	100	--	200	2,520
Soft maple	302	--	--	--	--	302
Beech	457	--	--	--	--	457
Ash	279	--	--	--	--	279
Cottonwood	518	--	--	59	--	577
Aspen	4,014	1,098	--	--	--	5,112
Basswood	211	--	--	--	--	211
Yellow-poplar	24	--	--	--	--	24
Black cherry	257	--	--	--	--	257
Elm	767	--	--	--	--	767
Paper birch	902	200	200	--	250	1,552
Other hardwoods	236	--	--	--	--	236
All species	12,663	1,498	300	59	450	14,970

in 1969. Particleboard manufacturing, one of the newer Michigan industries, is likely to expand and require more wood. The wood fence industry may also expand during favorable periods of business cycles and when housing starts are high.

Types of wood-using plants that have disappeared since 1946 include excelsior, charcoal, chemical wood, and clothespin manufacturers. Nonwood substitutes, plant obsolescence and competition from similar manufacturers in other States contributed to the closing of these types of plants.

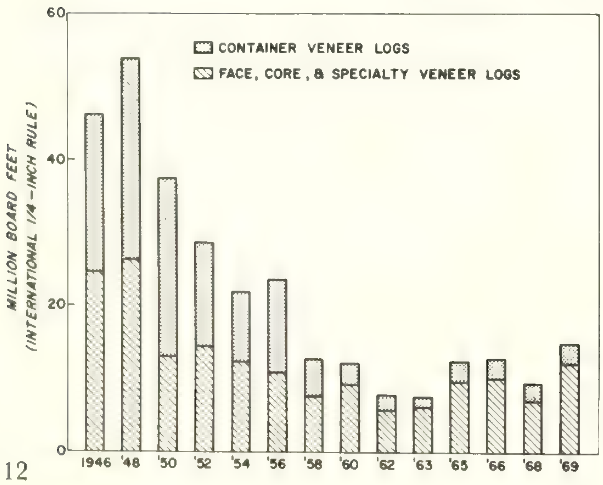

Figure 11. — *Veneer log receipts in Michigan for selected years, 1946-1969.*

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SOME RECENT RESOURCE BULLETINS PUBLISHED BY THE NORTH CENTRAL FOREST EXPERIMENT STATION

Pulpwood Production and Consumption in the North Central Region, by County, 1967, by James E. Blyth. USDA Forest Serv. Resource Bull. NC-6, 23 p., illus. 1969.

Indiana's Timber, by John S. Spencer, Jr. USDA Forest Serv. Resource Bull. NC-7, 61 p. illus. 1969.

Pulpwood Production in the North Central Region, by County, 1968, by James E. Blyth. USDA Forest Serv. Resource Bull. NC-8, 22 p., illus. 1969.

The Growing Timber Resource of Michigan, 1966, by Clarence D. Chase, Ray E. Pfeifer, and John S. Spencer, Jr. USDA Forest Serv. Resource Bull. NC-9, 62 p., illus. 1970.

Veneer-Log Production and Receipts, North Central Region, 1968, by Thomas P. Ginnaty, Jr. USDA Forest Serv. Resource Bull. NC-10, 8 p., illus. 1970.

Pulpwood Production in the North Central Region, by County, 1969, by James E. Blyth. USDA Forest Serv. Resource Bull. NC-11, 23 p., illus. 1970.

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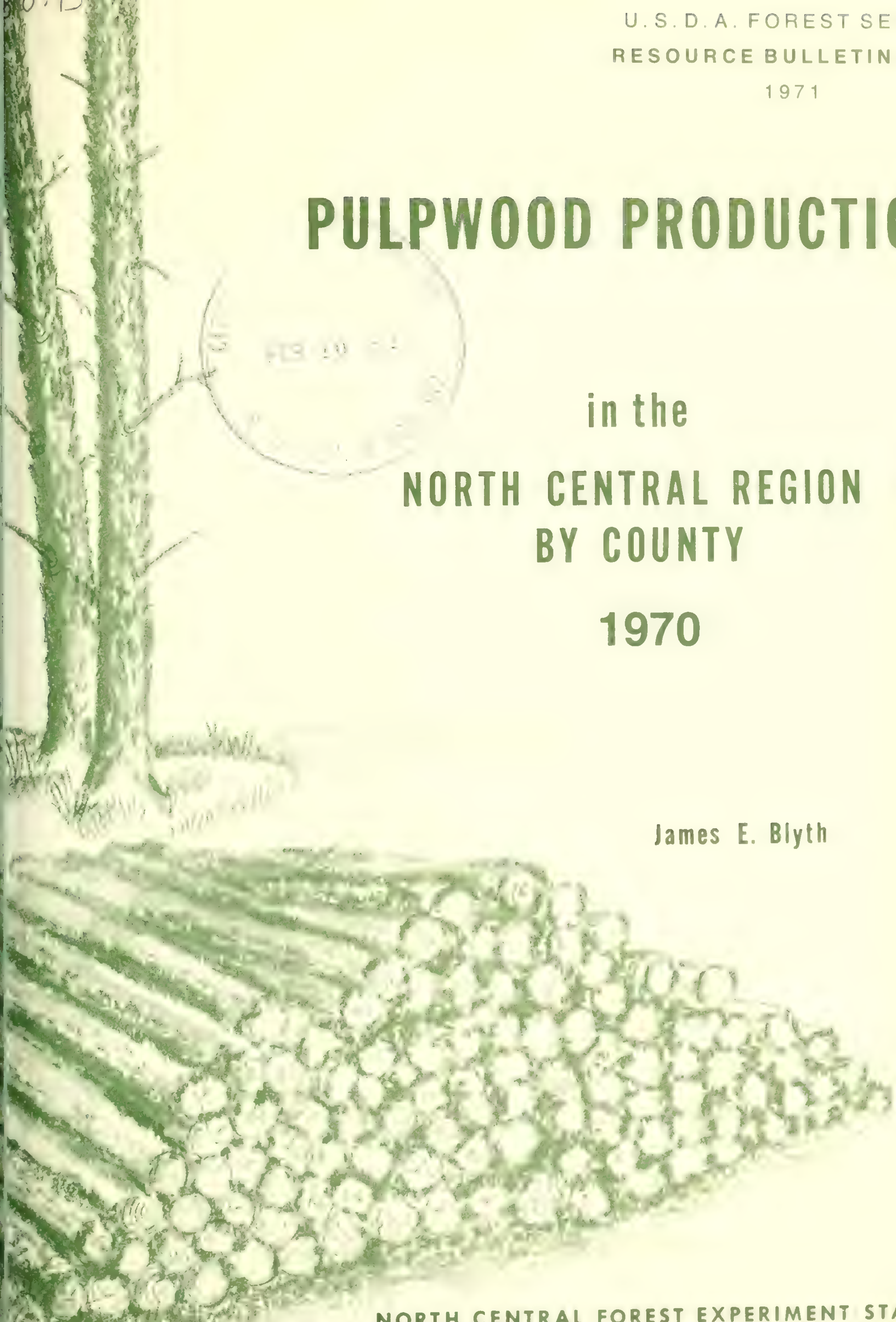

PULPWOOD PRODUCTION

in the
NORTH CENTRAL REGION
BY COUNTY
1970

FEB 10

James E. Blyth

NORTH CENTRAL FOREST EXPERIMENT STATION
U. S. DEPARTMENT OF AGRICULTURE
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PULPWOOD PRODUCTION IN THE NORTH CENTRAL REGION, BY COUNTY, 1970

James E. Blyth

This is the 12th annual report on the pulpwood harvest in Lake States counties and the 11th annual report on the Central States harvest. The Lake States (Michigan, Minnesota, and Wisconsin) and Central States (Illinois, Indiana, Iowa, and Missouri) are discussed separately because the timber types in each area are different and less information can be released about the Central States—more detailed data published on pulpwood production and receipts in the Central States would reveal the operations of individual mills.

Pulpmills using North Central States timber in 1970 reported their pulpwood receipts by State and county. Their cooperation is gratefully acknowledged. Thanks are also due to Ray Pfeifer, Staff Forester, Forest Resource Development, Michigan Department of Natural Resources, for collecting data on the Michigan pulpmills.

LAKE STATES

Although national production of paper and paperboard fell to 90 percent of capacity in 1970, Lake States pulpwood production rose moderately to a record high. Some pulpwood inventory buildup probably occurred during 1970.

Production Up 9 Percent

Lake States pulpwood production[1] nudged past the 1966 record to a new high of 4,287,000 cords in 1970, nearly 350,000 cords more than in 1969 (fig. 1). All but 1 percent was consumed in the Lake States. Ninety-two percent was roundwood; the remainder was residue[2] from local wood-using plants. Roundwood output rose 8 percent while Lake States residue used for pulping climbed 21 percent. Since 1964, hardwood residue sold by Lake States firms to pulpmills has increased an average of 18 percent annually (fig. 2). Seven out of eight cords of Lake States residue delivered to pulpmills were in chip form.

Harvests of all reported species increased. Pine, birch, and miscellaneous hardwoods production each advanced more than 50,000 cords. Technological advances in pulping birch spurred the use of this species since 1967. This trend is important because large volumes of paper birch are available in the Lake States and prospects are poor for increasing markets for other products.

One-fifth of the roundwood was peeled before delivery. Two-fifths of the aspen was peeled and constituted most of the peeled wood. Loggers peeled 59 percent of the aspen cut in Wisconsin, 39 percent in Michigan, and 16 percent in Minnesota (fig. 3).

1970 Pulpwood Production by State

Of the 1970 Lake States pulpwood cut, Wisconsin provided 39 percent, Michigan 33 percent, and Minnesota 28 percent.

The distribution of the pulpwood harvest is shown in two ways: first, the amount of pulpwood cut relative to commercial forest area, and second, the amount of pulpwood cut relative to the merchantable volume in major pulpwood species.

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[1] *Pulpwood production is defined as the pulpwood volume from timber lands in a specified area that was received at all mills during 1970, whereas pulpwood receipts are defined as the volume of wood received by mills in a specified area regardlesss of the geographic source.*

[2] *Residue is the byproduct from sawmills, veneer mills, cooperage mills, and other wood-using plants that is used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from these byproducts.*

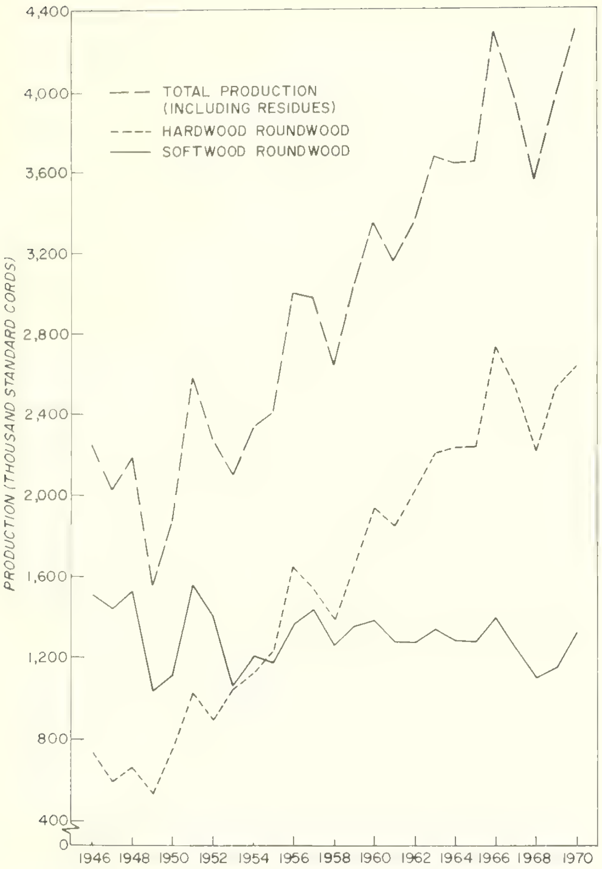

Figure 1.—Pulpwood production in the Lake States, 1946–1970.

More than 100 cords of pulpwood were cut per 1,000 acres of stocked commercial forest land in 3 Minnesota, 18 Wisconsin, and 18 Michigan counties (fig. 4). The rate of cutting per 1,000 cords of merchantable volume in principal pulpwood species was greatest in northeast Wisconsin and lowest in southern Wisconsin (fig. 5).

Wisconsin production 8 percent above previous peak.—All reported species groups contributed to the 213,000-cord roundwood harvest increase above 1969. Harvest gains were largest for aspen, miscellaneous hardwoods, and pine. Hardwood plant residue volume, supplied by Wisconsin sources for pulping, slipped moderately. Oneida, Marinette, and Lincoln County loggers cut the largest pulpwood volume. Production spurted 20,000 cords or more in Langlade, Marinette, Vilas, and Iron Counties.

Michigan output climbs more than 100,000 cords.—Major harvest increases were in pine and balsam

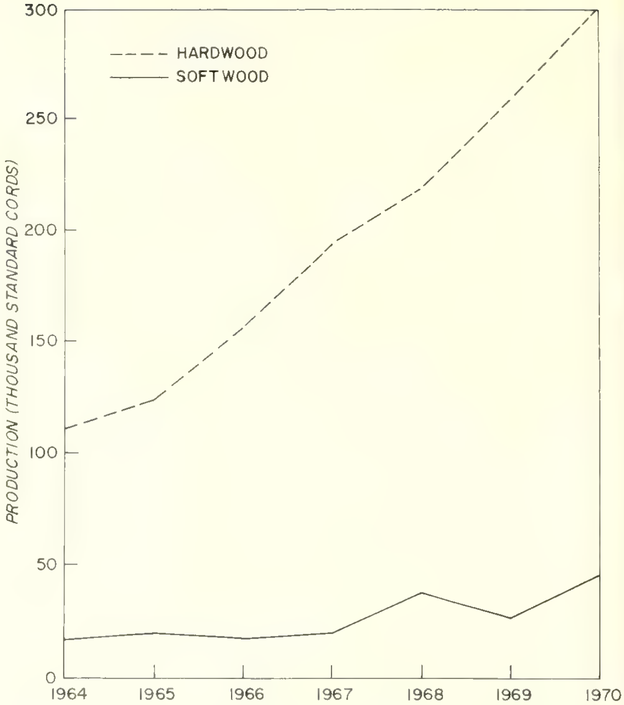

Figure 2.—Pulpwood production from Lake States residue, 1964–1970.

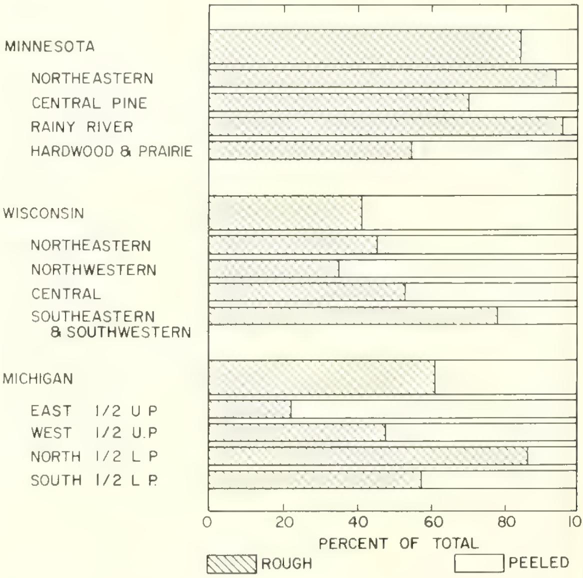

Figure 3.—Percent of rough and peeled aspen production of roundwood, by State and Forest Survey Unit, 1970.

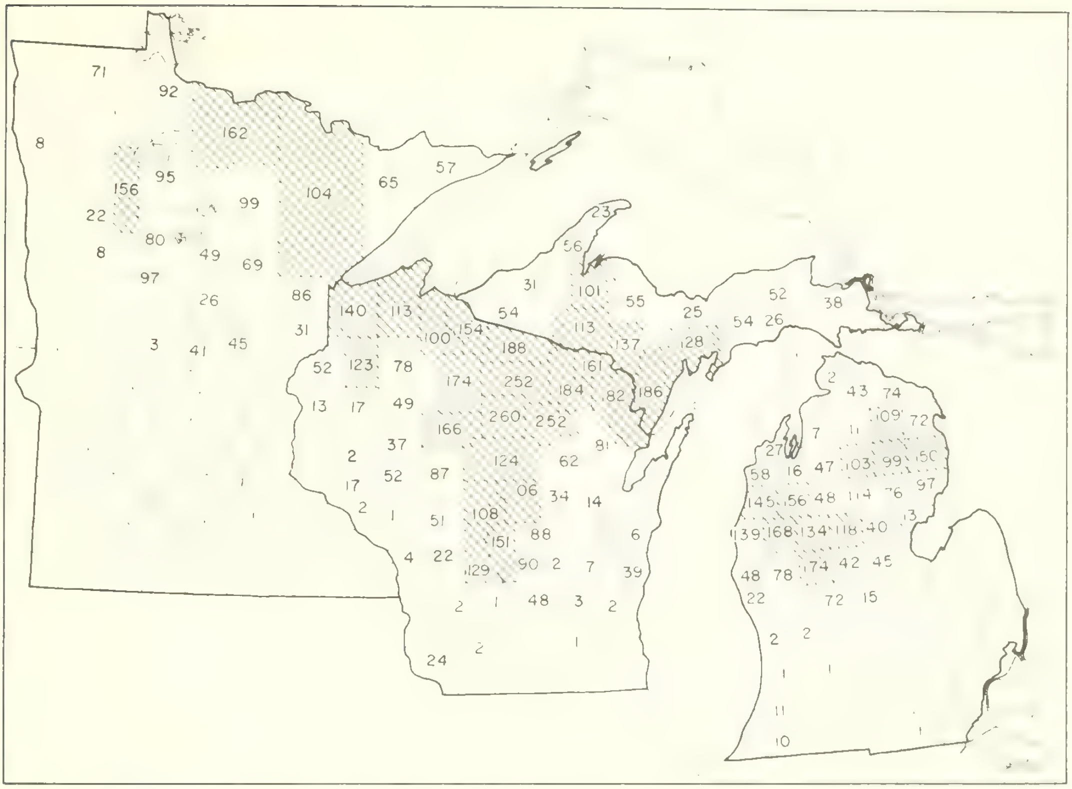

Figure 4.—Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1970. Crosshatching shows counties that supplied 100 or more cords of pulpwood per 1,000 acres of stocked commercial forest land.

fir. However, 3.6 cords of pine were cut for every cord of balsam fir. Most of the additional cut came from the eastern Upper Peninsula and the northern Lower Peninsula. Top-producing counties were Menominee, Delta, and Iron.

Minnesota production inches above 1967 all-time high.—Minnesota wood-using plants supplied 38,000 more cords of residue to pulpmills than in 1969. Roundwood harvesting was steady. Aspen production fell 60,000 cords but was offset by increases in birch and spruce. Three large counties—St. Louis, Koochiching, and Itasca—furnished 57 percent of the harvest.

Receipts Spurt 317,000 Cords

Forty-four Lake States plants received 4.7 million cords of pulpwood in 1970, more than in any year except 1966. Of those plants, 41 use aspen, 23 use spruce, and 19 use balsam fir (table 1). Nearly nine out of 10 cords received were roundwood or chips from roundwood.

Pine, birch, miscellaneous hardwoods, softwood residue, and hardwood residue receipts at regional mills were larger than ever before. Since 1964, softwood residue receipts have more than doubled and hardwood residue receipts have tripled.

Table 1.—*Number of plants using the different species of wood for pulping in 1970*

[illegible] of material	Lake States	Minn.	[illegible]	Mich.
Aspen	41	[illegible]	[illegible]	8
Balsam fir	19	5	[illegible]	5
Birch	8	1	[illegible]	2
Hemlock	7	[illegible]	[illegible]	1
Pine	11	[illegible]		3
Spruce	23	5	13	[illegible]
[illegible]	[illegible]	[illegible]	4	[illegible]
[illegible]	16	[illegible]	9	5
[illegible]	12	2	6	[illegible]
Slabwood and other residue	6	—	[illegible]	2
Total plants	[illegible]	9	[illegible]	[illegible]

Net imports from other States and Canada approached 400 thousand cords (table 2). Other States supplied nearly 3 out of 5 imported cords; Canada shipped the remainder.

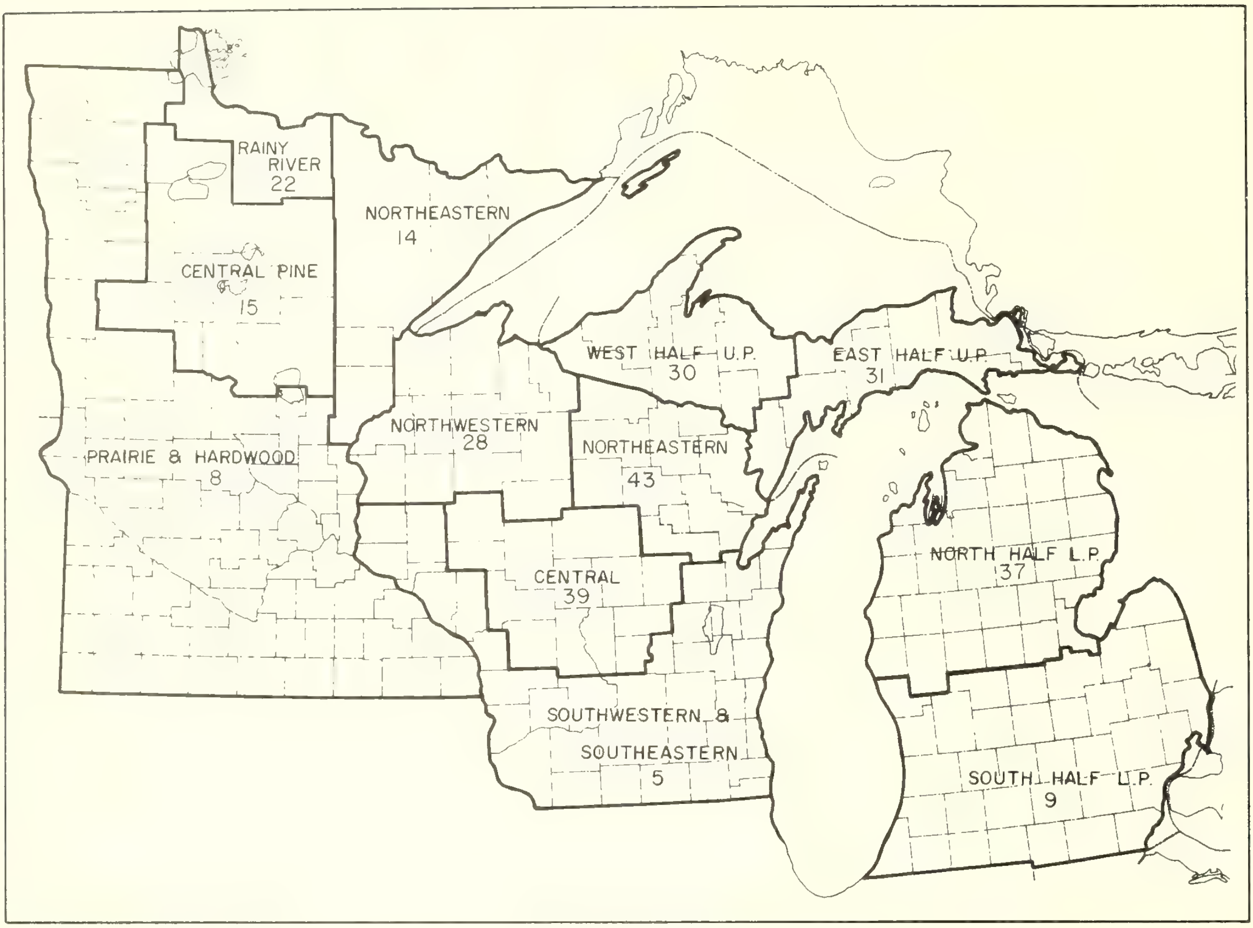

Figure 5.—Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species, by Forest Survey Unit, 1970. The heavy lines delineate the boundaries of the Forest Survey Units in each State.

Table 2.—*Pulpwood exports and imports for the Lake States, 1970*
(Thousand standard cords, unpeeled)

Species	Exports	Imports	Net exports or (imports)
Aspen	2	12	(10)
Birch	1	--	1
Balsam fir	*	--	*
Pine	1	119	(118)
Spruce	20	113	(93)
Mixed hardwoods	6	7	(1)
Residues, softwood	4	179	(175)
Residues, hardwood	11	12	(1)
Total	45	442	(397)

*Less than 500 cords.

Three-fourths of the softwood residue receipts at Lake States pulpmills came as chips from five western States—Colorado, Idaho, Montana, South Dakota, and Wyoming. These five States plus Nebraska provided 10 percent of the pine roundwood receipts. Spruce and pine are the primary imports from Canada.

Minnesota mills bought record volumes of birch roundwood, softwood residue, and hardwood residue. Birch purchases never before above 5,000 cords, jumped to 31,000 cords. Minnesota forests provided 93 percent of the State's pulpwood requirements.

Pulpwood procurement in Wisconsin exceeded all previous years. Demand for pine, birch, miscellaneous hardwoods, and hardwood residue reached new highs. Wisconsin received more than half of the Canadian wood and all of the wood imported from the western States, except a small quantity of spruce.

Pulpwood demand in Michigan remained steady for the fourth straight year. Pine purchases rose 31 percent and aspen purchases fell 7 percent. Softwood residue was received for pulping in Michigan for the first time in 1970.

Rising Regional Mill Capacity and Declining Number of Plants Expected

Regional pulpmill capacity is about 10,000 tons per day (table 3). During the next 2 or 3 years, pulping capacity is likely to expand, especially in the sulfate (kraft) process. At the same time, several small plants may close resulting in a net loss in the number of active plants. Two small Wisconsin pulpmills closed during 1970. Several other small operations have indicated they may close in the next year or two.

CENTRAL STATES

For the third consecutive year, Central States pulpwood production climbed. Rising pulpwood exports to new and expanding mills in surrounding States is the major reason for the production increase. Roundwood production is shifting from soft hardwoods[3] to hard hardwoods.

Production Over 400,000 Cords for First Time

Central States pulpwood production reached 406,000 cords in 1970, an 8 percent gain over 1969 (table 4). Most of the increase was in hard hardwood roundwood (including chips from roundwood). During the last 8 years, hard hardwood pulpwood cutting has risen sporadically while the cutting of soft hardwoods has declined significantly as shown below (in thousand cords):

Year	*Soft Hardwoods*	*Hard Hardwoods*
1962	164	87
1963	143	78
1964	151	86
1965	133	67
1966	131	95
1967	105	78
1968	117	93
1969	98	88
1970	97	117

Use of hard hardwoods has increased because the fiber yield per unit of weight is greater than for soft hardwoods. In addition, loggers usually prefer to cut hard hardwoods when they are paid on a weight basis without a delivered price differential between hard and soft hardwoods.

Pulpwood output from plant residue held steady in 1970 and accounted for almost half the area's production. From 1965 to 1969, buying of Central States residue for pulping increased phenomenally for several reasons (fig. 6). Some sawmills installed debarkers and chippers to upgrade their residue to the quality needed by pulpmills. Some pulpmills had difficulty obtaining roundwood because woods labor was scarce, but found other primary wood-using mills to be reliable suppliers of wood chips from their plant byproducts. Finally, less woodyard space is required at pulpmills when chips from byproducts are substituted for roundwood.

Pulping of Central States residue will probably continue to increase for the same reasons. In addition, new pollution control laws restricting burning of waste material may stimulate primary mills to locate pulpwood outlets for their byproducts.

Exports rose sharply to 87,000 cords, more than twice the 1969 level. New and expanding Kentucky mills received nearly three-fourths of this wood with the remainder shipped to Michigan, Minnesota, Mississippi, and Ohio. Export markets are important to Indiana and are becoming important to Missouri (table 5). These markets have not developed significantly for Illinois producers but are likely to do so within a few years. Most Iowa pulpwood markets will probably continue to be within the Central States. Several large modern pulpmills, adjacent to the Central States and purchasing wood from this area, are expected to boost their purchases. By contrast, export markets are relatively unimportant outlets for Lake States wood.

Each Central State, except Illinois, produced a record volume of pulpwood in 1970. Iowa production nearly doubled from 1969. Pulpwood output has increased four consecutive years in Missouri and three in Indiana.

During 1970, the Iowa roundwood harvest rose abruptly while changing only slightly in each of the other States.

The number of Central States counties supplying roundwood increased from 122 in 1969 to 145 in 1970. Forty-nine were in Indiana, 46 in Illinois, 31 in Missouri, and 19 in Iowa (fig. 7). Top-producing counties in each

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[3] *Soft hardwoods include species such as elm, basswood, soft maple, yellow-poplar, and cottonwood. Hard hardwoods include oak, hard maple, beech, and hickory.*

Table 3.—*Active woodpulp mills in the Lake States, by location, type of pulp produced, and capacity, 1970*

Company	Location	Mill capacity in tons per 24 hours[1]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Minnesota:						
Blandin Paper Co.	Grand Rapids	205	--	--	205	--
Hennepin Paper Co.	Little Falls	65	--	--	65	--
Boise Cascade Corp.	International Falls	850	--	300	550	--
Northwest Paper Co., The	Cloquet	425	120	305	--	--
Nu-Ply Corp.	Bemidji	75	--	--	75	--
St. Regis Paper Co.	Sartell	125	--	--	125	--
Superwood Corp.	Duluth	240	--	--	240	--
Hoerner Waldorf Corp.	St. Paul	300	--	--	--	300
Conwed Corp.	Cloquet	350	--	--	350	--
Total	9 plants	2,635	120	605	1,610	300
Wisconsin:						
American Can Co.	Green Bay	210	150	--	60	--
American Can Co.	Rothschild	190	190	--	--	--
Badger Paper Mills, Inc.	Peshtigo	90	90	--	--	--
Combined Paper Mills, Inc.	Combined Locks	175	--	--	175	--
Consolidated Papers, Inc.	Appleton	155	155	--	--	--
Consolidated Papers, Inc.	Stevens Point	100	--	--	100	--
Consolidated Papers, Inc.	Wisconsin Rapids	655	--	360	295	--
Green Bay Packaging, Inc.	Green Bay	200	--	--	--	200
Kansas City Star Co.	Park Falls	115	115	--	--	--
Kimberly-Clark Corp.	Kimberly	150	--	--	150	--
Kimberly-Clark Corp.	Niagara	150	--	--	150	--
Mosinee Paper Mills Co.	Mosinee	200	--	200	--	--
Nekoosa-Edwards Paper Co.	Nekoosa	310	--	310	--	--
Nekoosa-Edwards Paper Co.	Port Edwards	215	215	--	--	--
Owens-Illinois	Tomahawk	615	--	--	--	615
Charmin Paper Products Co.	Green Bay	[2]	[2]	--	[2]	--
Scott Paper Co.	Marinette	50	50	--	--	--
Scott Paper Co.	Oconto Falls	110	110	--	--	--
St. Regis Paper Co.	Rhinelander	120	120	--	--	--
St. Regis Paper Co.	Cornell	50	--	--	50	--
Sterling Pulp & Paper Co.[3]	Eau Claire	60	--	--	60	--
Superior Fiber Products Co.	Superior	140	--	--	140	--
Thilmany Pulp & Paper Co.	Kaukauna	375	--	375	--	--
Tomahawk Pulp Co., Inc.	Tomahawk	50	--	--	50	--
Wausau Paper Mills Co.	Brokaw	145	145	--	--	--
Evans Products Co.	Phillips	80	--	--	80	--
Total	26 plants	4,710	1,340	1,245	1,310	815
Michigan:						
Abitibi Corp.	Alpena	430	--	--	430	--
Celotex Corp.	L'Anse	270	--	--	270	--
Hoerner Waldorf Corp.	Ontonagon	250	--	--	--	250
Manistique Pulp & Paper Co.	Manistique	90	--	--	90	--
Mead Corp., The	Groos	100	--	--	100	--
Menasha Corp.	Otsego	225	--	--	--	225
Packaging Corp. of America.	Filer City	600	--	200	--	400
Scott Paper Co.	Menominee	20	--	--	20	--
Warren Co., S.D.	Muskegon	225	--	225	--	--
Total	9 plants	2,210	--	425	910	875
All States	44 plants	9,555	1,460	2,275	3,830	1,990

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[1] Lockwood's Directory of the Paper and Allied Industries-1970, and 1971 Directory of the Forest Products Industry.

[2] Capacity not available.

[3] Pulpmill closed permanently in July 1970.

Table 4.—*Central States pulpwood production and receipts, by State, 1970*

(In standard cords unpeeled)[1]

Species group and destination	Production 2/					Imports			Total receipts
	Illinois	Indiana	Iowa	Missouri	Region	Lake States	Other U. S.	Total imports	
Softwoods									
Illinois	1,200	--	--	--	1,200	--	--	--	1,200
Ind., Iowa, Mo. 3/	80	--	80	--	160	--	--	--	160
Exported 4/	--	9	--	301	310	--	--	--	--
Total	1,280	9	80	301	1,670	--	--	--	1,360
Soft hardwoods									
Illinois	29,192	1,302	1,111	311	31,916	1,332	444	1,776	33,692
Ind., Iowa, Mo. 3/	4,114	26,047	15,210	14,151	59,522	1,000	1,000	2,000	61,522
Exported 4/	[illegible]	4,018	--	1,291	5,574	--	--	--	--
Total	33,571	31,367	16,321	15,753	97,012	2,332	1,444	3,776	95,214
Hard hardwoods									
Illinois	22,965	3,927	--	120	27,012	--		--	27,012
Ind., Iowa, Mo. 3/	7,788	31,702	19,700	4,769	63,959	2,700	2,415	5,115	69,074
Exported 4/	955	19,881	--	4,825	25,661	--	--	--	--
Total	31,708	55,510	19,700	9,714	116,632	2,700	2,415	5,115	96,086
Total roundwood									
Illinois	53,357	5,229	1,111	431	60,128	1,332	444	1,776	61,904
Ind., Iowa, Mo. 3/	11,982	57,749	34,990	18,920	123,641	3,700	3,415	7,115	130,756
Exported 4/	1,220	23,908	--	6,417	31,545	--	--	-	--
Total	66,559	86,886	36,101	25,768	215,314	5,032	3,859	8,891	192,660
Residues softwood									
Illinois	968	--	10,227	--	11,195	2,287	6,091	8,378	19,573
Ind., Iowa, Mo. 3/	--	--	--	--	-	--	3,799	3,799	3,799
Exported 4/	433	--	--	626	1,059	--	--		--
Total	1,401	--	10,227	626	12,254	2,287	9,890	12,177	23,372
Residues hardwood									
Illinois	28,784	206	1,818	36,597	67,405	7,132	5,813	[illegible]	80,350
Ind., Iowa, Mo. 3/	14,615	31,334	8,581	1,485	56,015	3,727	5,324	9,051	65,066
Exported 4/	6,661	29,364	954	17,643	54,622	--	--	--	--
Total	50,060	60,904	11,353	55,725	178,042	10,859	11,137	21,996	145,416
All wood material									
Illinois	83,109	5,435	13,156	37,028	138,728	10,751	12,348	23,099	161,827
Ind., Iowa, Mo. 3/	26,597	89,083	43,571	20,405	179,656	7,427	12,538	19,965	199,621
Exported 4/	8,314	53,272	954	24,686	87,226	-			--
Total	118,020	147,790	57,681	82,119	405,610	18,178	24,886	43,064	[illegible]

1/ Factors used in converting to standard green cords (128 cu. ft.) were: 4,500 pounds of soft hardwood roundwood; 5,000 pounds of hard hardwood or coniferous roundwood; 4,100 pounds of softwood chips (green); 4,400 pounds of hardwood chips (green); 2,500 pounds of chips (all species, dry).

2/ Vertical columns of figures under box heading "Production" present the amount of pulpwood cut in each State.

3/ Combined to prevent disclosure of individual mill receipts.

4/ Pulpwood shipped to mills outside the region.

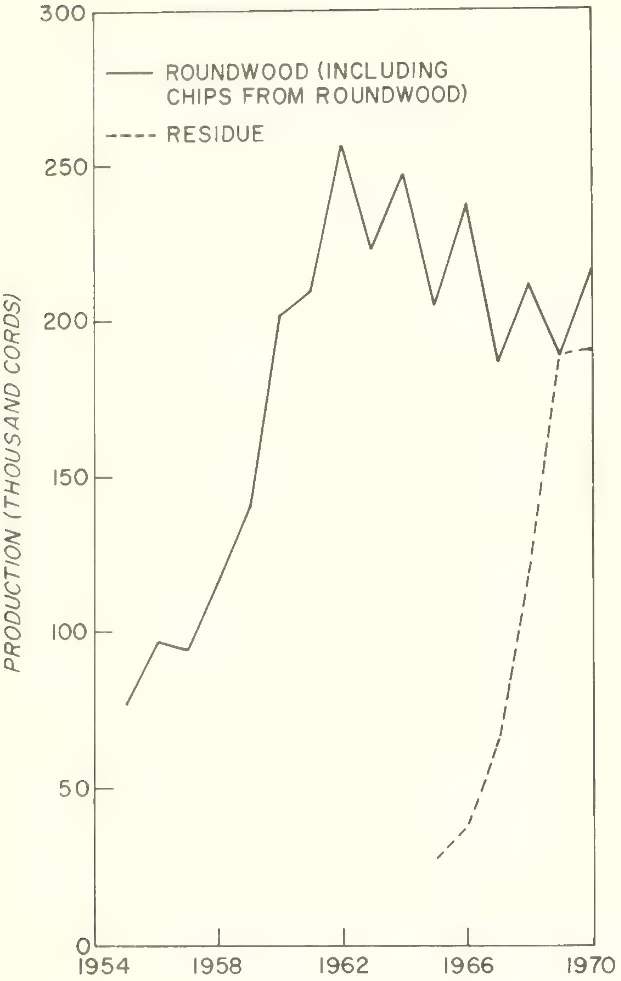


Figure 6.—Pulpwood production from Central States roundwood and residue, 1955–1970. (Data for residue not available before 1965, but was negligible.)

State were Jackson and Lawrence in Indiana, Alexander and Pulaski in Illinois, Mississippi and Clark in Missouri, and Dubuque and Louisa in Iowa.

Receipts Drop Nine Percent

Fifteen Central States plants received 361,000 cords in 1970, 34,000 cords below 1969. Roundwood purchases were stable while procurement of residue fell (table 6). Imports slipped to 12 percent of all wood receipts as compared with 15 percent in 1969.

Pulping capacity was about 1,500 tons per day at the end of 1970 (table 7). One Indiana pulpmill closed during the year. No major expansions were announced at the other mills.

Table 6.—*Trends in receipts (thousand standard cords, unpeeled) of roundwood and residue as pulpwood, Central States, 1966–1970*

Type of material and area	1966	1967	1968	1969	1970
Roundwood					
Illinois	84	63	68	50	62
Indiana, Iowa, Missouri	163	138	156	146	131
Total	247	201	224	196	193
Residue					
Illinois	25	50	92	135	100
Indiana, Iowa, Missouri	29	37	50	64	68
Total	54	87	142	199	168
All material	301	288	366	395	361

Table 5.—*Central States pulpwood production by State and destination, 1965–1970*
(Thousand cords)

Year	Illinois			Indiana			Iowa			Missouri		
	Total	Destination		Total	Destination		Total	Destination		Total	Destination	
		Central States	Other States		Central States	Other States		Central States	Other States		Central States	Other States
1965	92	89	2	86	81	5	31	31	*	22	20	2
1966	121	121	*	96	87	9	36	36	--	22	19	3
1967	96	96	*	84	77	7	35	35	*	37	37	—
1968	115	115	--	118	102	16	38	37	1	62	62	*
1969	132	128	4	132	107	25	31	30	1	81	71	10
1970	118	110	8	148	95	53	58	57	1	82	57	25

*Less than 500 cords.

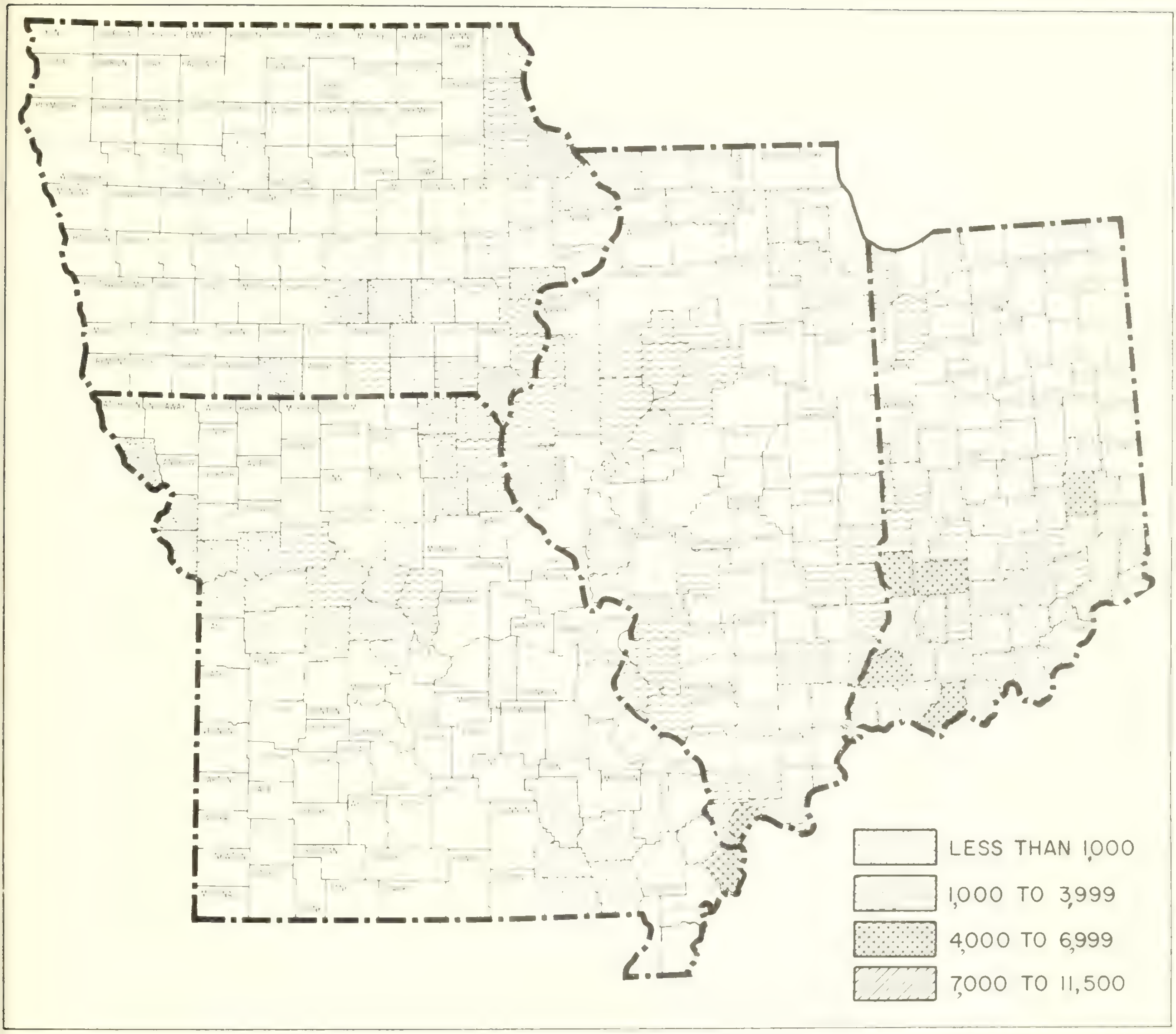


Figure 7.—Harvest of pulpwood bolts in the Central States, by counties, in standard cords, 1970.

Table 7.—*Active woodpulp mills in the Central States by location, type of pulp produced, and capacity, 1970*

Company	Location	Mill capacity in tons per 24 hours[1/]				
		Total	Sulfite	Sulfate	Groundwood and other mechanical	Semi-chemical
Illinois:						
Philip Carey Corp.	Wilmington	30	--	--	30	--
Celotex Corp.	Peoria	190	--	--	190	--
Alton Box Board Co.	Alton	300	--	--	--	300
Bird & Son, Inc.	Chicago	40	--	--	40	--
Certain-Teed Products Corp.	East St. Louis	100	--	--	100	--
Flintkote Co., The	Mt. Carmel	40	--	--	40	--
Johns-Manville Products Corp.	Waukegan	65	--	--	65	--
GAF Corp.	Joliet	100	--	--	100	--
Total	8 plants	865	--	--	565	300
Indiana:						
Container Corp. of America 2/	Carthage	120	--	--	--	120
Weston Paper & Manufacturing Co.	Terre Haute	250	--	--	--	250
Total	2 plants	370	--	--	--	370
Iowa:						
Celotex Corp.	Dubuque	90	--	--	--	90
Consolidated Packaging Corp.	Fort Madison	135	--	--	--	135
United States Gypsum Co.	Fort Dodge	3/	--	--	--	--
Total	3 plants	225	--	--	--	225
Missouri:						
Huebert Fiberboard, Inc.	Booneville	60	--	--	60	--
GAF Corp.	Kansas City	110	--	--	110	--
Total	2 plants	170	--	--	170	--
All States	15 plants	1,630	--	--	735	895

1/ Lockwood's Directory of the Paper and Allied Industries-1970, and 1971 Directory of the Forest Products Industry.

2/ Pulpmill phased out in 1970.

3/ Capacity not available.

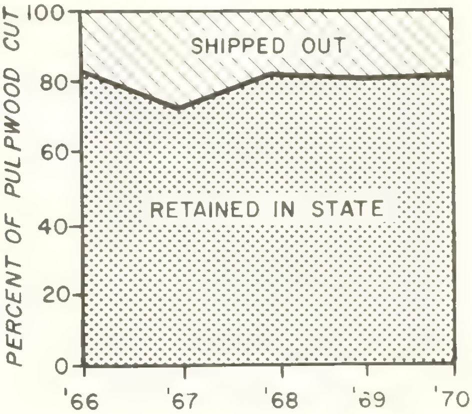
APPENDIX

Table 8.—*Lake States pulpwood production, by State of origin and destination, 1966–1970*

MINNESOTA

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1966	1,174	970	193	*	11
1967	1,205	884	299	*	22
1968	1,087	900	166	*	21
1969	1,192	977	188	--	27
1970	1,224	981	219	*	24
5-year average	1,176	942	213	*	21

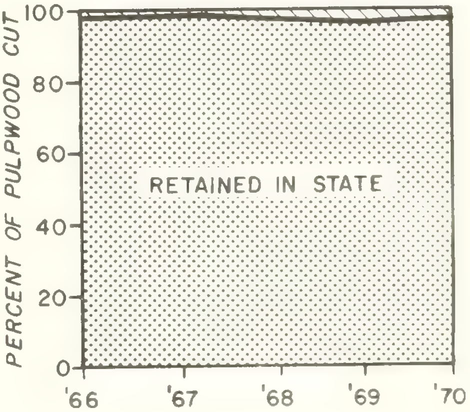
*Less than 500 cords.



WISCONSIN

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1966	1,536	13	1,501	3	19
1967	1,416	15	1,387	*	14
1968	1,297	22	1,259	4	12
1969	1,450	17	1,412	[illegible]	12
1970	1,656	11	1,627	10	[illegible]
5-year average	1,471	16	1,437	5	13

*Less than 500 cords.



MICHIGAN

Year	Total cut	Destination of pulpwood: Minn.	Wis.	Mich.	Other
		(Thousand standard cords)			
1966	1,570	1	666	901	2
1967	1,344	--	660	684	*
1968	1,168	--	455	702	11
1969	1,302	--	537	752	13
1970	1,406	--	610	785	11
5-year average	1,358	*	586	764	[illegible]

*Less than 500 cords.

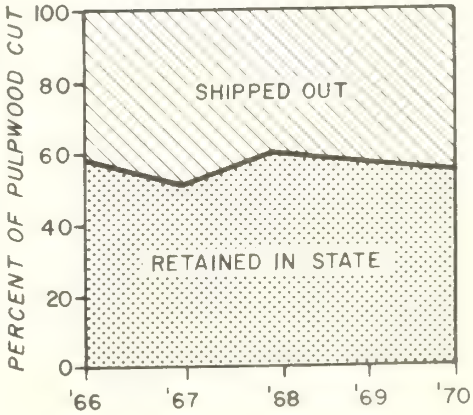


Table 9.—*Lake States pulpwood receipts by State and species, 1970*

(Thousand standard cords, roughwood basis)

Species	Minnesota	Wisconsin	Michigan	Total receipts
Aspen	557	1,088	332	1,977
Balsam fir	42	112	26	180
Birch	31	80	28	139
Hemlock	--	118	3	121
Pine	188	498	152	838
Spruce	111	208	22	341
Tamarack	--	43	--	43
Misc. hardwoods	33	333	154	520
All roundwood	962	2,480	717	4,159
Residue, softwood	22	189	11	221
Residue, hardwood	74	152	77	304
All wood material	1,058	2,821	805	4,684

Table 10.—*Lake States pulpwood production, by Forest Survey Unit and destination by State, 1970*

(Thousand standard cords, roughwood basis)

MINNESOTA

Unit	Total cut	Destination of pulpwood: Minnesota	Wisconsin	Michigan	Other
Northeastern	452	336	112	*	4
Central Pine	436	346	90	*	--
Rainy River	268	237	11	--	20
Hardwood & Prairie	68	62	6	--	--
Total	1,224	981	219	*	24

WISCONSIN

Unit	Total cut	Destination of pulpwood: Minnesota	Wisconsin	Michigan	Other
Northeastern	774	--	763	10	1
Northwestern	581	3	578	--	--
Central	255	2	253	--	*
Southeastern & Southwestern	46	6	33	--	7
Total	1,656	11	1,627	10	8

MICHIGAN

Unit	Total cut	Destination of pulpwood: Minnesota	Wisconsin	Michigan	Other
E. 1/2 Up. Pen.	329	--	247	72	10
W. 1/2 Up. Pen.	407	--	363	44	--
N. 1/2 Low. Pen.	615	--	--	614	1
S. 1/2 Low. Pen.	55	--	--	55	--
Total	1,406	--	610	785	11

*Less than 500 cords.

Table 11.—*Lake States pulpwood production by species, State, and Survey Unit, 1966–1970*

(Thousand standard cords, roughwood basis)

Unit	ASPEN					BALSAM FIR				
	Annual production					Annual production				
	1966	1967	1968	1969	1970	1966	1967	1968	1969	1970
MINNESOTA										
Northeastern	205	205	203	204	208	20	26	12	10	9
Central Pine	272	265	218	289	249	35	30	18	18	22
Rainy River	123	108	131	148	127	25	20	13	12	14
Prairie & Hardwood	12	13	31	19	16	--	--	*	--	*
Total	612	591	583	660	600	80	76	43	40	45
WISCONSIN										
Northeastern	449	430	369	416	430	28	26	25	28	40
Northwestern	298	273	202	244	296	26	21	22	22	29
Central	61	35	55	35	44	1	*	4	*	*
Southeastern & Southwestern	2	1	3	2	1	--	*	--	--	--
Total	810	739	629	697	771	55	47	51	50	69
MICHIGAN										
E. 1/2 Up. Pen.	156	144	95	119	124	48	50	39	27	41
W. 1/2 Up. Pen.	222	237	167	184	180	37	38	22	16	25
N. 1/2 Low. Pen.	388	258	274	296	288	3	3	1	1	*
S. 1/2 Low. Pen.	10	7	5	7	4	--	--	--	--	--
Total	776	646	541	606	596	88	91	62	44	66
LAKE STATES	2,198	1,976	1,753	1,963	1,967	223	214	156	134	180

*Less than 500 cords.

(Continued on next page)

(Table 11 continued)

MINNESOTA

Unit	BIRCH					HEMLOCK				
	Annual production					Annual production				
	1966	1967	1968	1969	1970	1966	1967	1968	1969	1970
Northeastern	--	1	*	3	17	--	--	--	--	--
Central Pine	1	2	1	*	12	--	--	--	--	--
Rainy River	--	--	--	--	2	--	--	--	--	--
Prairie & Hardwood	--	--	--	--	*	--	--	--	--	--
Total	1	3	1	3	31	--	--	--	--	--
WISCONSIN										
Northeastern	9	28	18	23	32	48	27	22	32	33
Northwestern	26	46	35	37	42	18	13	18	16	16
Central	4	10	3	3	2	3	2	4	3	3
Southeastern & Southwestern	--	*	*	--	--	--	--	*	--	--
Total	39	84	56	63	76	69	42	44	51	52
MICHIGAN										
E. 1/2 Up. Pen	3	3	2	1	4	21	16	9	11	17
W. 1/2 Up. Pen.	2	2	*	1	2	78	44	36	52	52
N. 1/2 Low. Pen.	8	6	11	21	27	--	--	--	*	*
S. 1/2 Low. Pen.	--	--	--	*	--	--	--	--	--	--
Total	13	11	13	23	33	99	60	45	63	69
LAKE STATES	53	55	70	89	140	168	102	89	114	121

*Less than 500 cords.

(Continued on next page)

(Table 11 continued)

MINNESOTA

Unit	JACK PINE[1/]					SPRUCE				
	Annual production					Annual production				
	1966	1967	1968	1969	1970	1966	1967	1968	1969	1970
Northeastern	138	108	121	133	123	78	93	66	66	64
Central Pine	85	69	62	74	68	31	45	31	27	31
Rainy River	15	11	12	18	19	61	79	60	60	85
Prairie & Hardwood	18	14	8	12	11	2	1	*	1	1
Total	256	202	203	237	221	172	218	157	154	181
WISCONSIN										
Northeastern	58	45	46	63	72	14	10	7	10	12
Northwestern	92	61	57	77	96	4	3	3	3	4
Central	64	67	94	75	87	*	*	1	*	*
Southeastern & Southwestern	1	1	2	1	4	--	--	--	--	--
Total	215	174	199	216	259	18	13	11	13	16
MICHIGAN										
E. 1/2 Up. Pen.	63	40	39	59	57	31	33	23	20	29
W. 1/2 Up. Pen.	47	36	33	38	34	42	40	16	18	22
N. 1/2 Low. Pen.	138	115	131	109	145	1	2	*	1	*
S. 1/2 Low. Pen.	2	2	2	1	4	--	--	--	--	--
Total	250	193	205	207	240	74	75	39	39	51
LAKE STATES	721	569	607	660	720	264	306	207	206	248

*Less than 500 cords.

[1/] Includes small quantity of red and white pine.

(Continued on next page)

(Table 11 continued)

MINNESOTA

Unit	TAMARACK					MISC. HARDWOODS				
	Annual production					Annual production				
	1966	1967	1968	1969	1970	1966	1967	1968	1969	1970
Northeastern	1	6	4	4	5	4	9	7	11	14
Central Pine	6	27	16	14	23	13	6	5	11	3
Rainy River	*	4	4	2	7	13	23	9	8	9
Prairie & Hardwood	*	3	1	1	1	1	1	2	2	1
Total	7	40	25	21	36	31	39	23	32	27
WISCONSIN										
Northeastern	1	2	3	1	2	80	64	60	87	110
Northwestern	2	1	2	1	2	70	62	50	61	79
Central	*	--	*	*	*	84	71	68	81	99
Southeastern & Southwestern	--	--	--	--	--	8	6	7	9	8
Total	3	3	5	2	4	242	203	185	238	296
MICHIGAN										
E. 1/2 Up. Pen.	1	1	1	1	2	16	6	3	10	18
W. 1/2 Up. Pen.	*	*	1	1	1	70	79	48	38	28
N. 1/2 Low. Pen.	--	--	--	--	--	103	112	116	141	143
S. 1/2 Low. Pen.	--	--	--	--	--	5	2	4	7	7
Total	1	1	2	2	3	194	199	171	196	196
LAKE STATES	11	44	32	25	43	467	484	379	466	519

*Less than 500 cords.

(Continued on next page)

(Table 11 continued)

MINNESOTA

Unit	RESIDUE					ALL SPECIES[1/]				
	Annual production					Annual production				
	1966	1967	1968	1969	1970	1966	1967	1968	1969	1970
Northeastern	3	11	8	6	12	449	459	421	437	452
Central Pine	6	9	12	4	28	449	453	363	437	436
Rainy River	--	4	11	5	5	237	249	240	253	268
Prairie & Hardwood	6	12	21	30	38	39	44	63	65	68
Total	15	36	52	45	83	1,174	1,205	1,087	1,192	1,224
WISCONSIN										
Northeastern	49	41	53	49	43	736	673	603	709	774
Northwestern	7	22	21	17	17	543	502	410	478	581
Central	5	22	16	16	20	222	207	245	213	255
Southeastern & Southwestern	24	26	27	38	33	35	34	39	50	46
Total	85	111	117	120	113	1,536	1,416	1,297	1,450	1,656
MICHIGAN										
E. 1/2 Up. Pen.	11	2	2	29	37	350	295	213	277	329
W. 1/2 Up. Pen.	23	32	34	54	63	521	508	357	402	407
N. 1/2 Low. Pen.	3	11	16	6	12	644	507	549	575	615
S. 1/2 Low. Pen.	38	23	38	33	40	55	34	49	48	55
Total	75	68	90	122	152	1,570	1,344	1,168	1,302	1,406
LAKE STATES	175	215	259	287	348	4,280	3,965	3,552	3,944	4,286

1/ Including residues.

Table 12.—*Lake States pulpwood production by county and species, 1970*

(Thousand standard cords, roughwood basis)

WISCONSIN

Unit and county[1]	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues[2]
NORTHEASTERN:										
Florence	42	29	5	*	3	1	2	--	2	
Forest	95	60	6	2	7	4	1	*	15	
Langlade	95	66	2	5	1	4	*	*	17	
Lincoln	103	66	2	5	1	3	1	*	25	
Marinette	116	77	10	3	2	13	3	*	8	
Oconto	29	23	1	*	*	3	*	--	2	
Oneida	141	62	8	9	4	27	4	2	25	
Shawano[3]	30	15	*	*	10	1	*	*	4	
Vilas	80	32	6	8	5	16	1	--	12	
Total	774	430	40	32	33	72	12	2	110	43
NORTHWESTERN:										
Ashland	52	24	9	3	4	4	1	*	7	
Barron	2	*	--	*	--	*	--	--	2	
Bayfield	85	51	1	7	1	22	*	*	3	
Burnett	16	2	--	--	--	13	--	1	*	
Douglas	84	52	1	2	--	28	1	*	*	
Iron	57	42	3	3	3	*	*	*	6	
Polk	3	1	--	--	--	2	--	--	--	
Price	102	52	9	13	2	3	1	*	22	
Rusk	16	10	*	2	*	*	*	*	4	
Sawyer	47	18	5	8	2	4	1	*	9	
Taylor	59	27	1	3	4	1	*	*	23	
Washburn	41	17	*	1	*	19	*	1	3	
Total	581	296	29	42	16	96	4	2	79	17
CENTRAL:										
Adams	37	2	--	--	--	18	--	--	17	
Chippewa	8	6	*	1	*	1	*	--	*	
Clark	23	8	*	*	*	3	--	--	12	
Eau Claire	8	1	--	*	--	7	--	*	*	
Jackson	17	1	--	*	--	15	--	--	1	
Juneau	30	2	--	*	--	19	--	--	9	
Marathon	45	16	*	1	3	2	*	*	23	
Marquette	9	--	--	--	--	1	--	--	8	
Monroe	4	*	--	--	--	3	--	--	1	
Portage	16	3	*	*	*	5	*	*	8	
Waupaca	5	3	*	*	*	*	*	*	2	
Waushara	10	*	--	--	--	6	*	*	4	
Wood	23	2	--	*	*	7	--	--	14	
Total	255	44	*	2	3	87	*	*	99	20

(Continued on next page)

(Table 12 continued)

WISCONSIN (continued)

Unit and county 1/	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues 2/
SOUTHWESTERN:										
Buffalo	*	--	--	--	--	*	--	--	--	
Dunn	*	--	--	--	--	*	--	--	--	
Grant	4	--	--	--	--	--	--	--	4	
Iowa	*	--	--	--	--	--	--	--	*	
La Crosse	1	--	--	--	--	1	--	--	--	
Pepin	1	--	--	--	--	1	--	--	--	
Richland	*	--	--	--	--	*	--	--	--	
Sauk	*	--	--	--	--	*	--	--	--	
Trempealeau	*	*	--	--	--	--	--	--	--	
Total	30	*	--	--	--	2	--	--	4	24
SOUTHEASTERN:										
Columbia	4	--	--	--	--	2	--	--	2	
Dodge	*	--	--	--	--	--	--	--	*	
Fond du Lac	*	--	--	--	--	*	--	--	*	
Green Lake	*	--	--	--	--	*	--	--	--	
Jefferson	*	--	--	--	--	--	--	--	*	
Manitowoc	*	--	--	--	--	--	--	--	*	
Outagamie	1	1	--	--	--	*	--	--	*	
Sheboygan	2	--	--	--	--	--	--	--	2	
Washington	*	--	--	--	--	--	--	--	*	
Total	16	1	--	--	--	2	--	--	4	9
State total	1,656	771	69	76	52	259	16	4	296	113

1/ Includes only those counties that supplied pulpwood in 1970.
2/ County figures are not available.
3/ Includes Menominee County.
* Less than 500 cords.

(Continued on next page)

MICHIGAN

Unit and county[1/]	All species	Aspen	Balsam	Birch	Hemlock	Pine	Spruce	Tamarack	Misc. hdwds.	Residues[2/]
E. 1/2 UP. PEN.:										
Alger	13	2	1	--	1	6	1	--	2	
Chippewa	29	6	2	*	2	12	4	1	2	
Delta	79	31	18	1	4	10	11	*	4	
Luce	27	2	1	*	3	17	2	*	2	
Mackinac	15	4	1	1	*	3	1	--	5	
Menominee	95	69	13	1	2	*	8	1	1	
Schoolcraft	34	10	5	1	5	9	2	*	2	
Total	329	124	41	4	17	57	29	2	18	37
W. 1/2 UP. PEN.:										
Baraga	54	24	1	1	16	6	2	--	4	
Dickinson	61	43	6	*	2	2	6	1	1	
Gogebic	34	14	1	1	10	1	*	--	7	
Houghton	31	16	1	*	10	1	1	--	2	
Iron	77	50	5	*	4	2	3	*	13	
Keweenaw	5	*	3	--	--	--	2	*	--	
Marquette	60	18	7	*	5	22	8	*	*	
Ontonagon	22	15	1	*	5	*	*	--	1	
Total	407	180	25	2	52	34	22	1	28	63
N. 1/2 LOW. PEN.:										
Alcona	47	31	*	3	--	1	*	--	12	
Alpena	15	9	*	2	--	1	*	--	3	
Antrim	1	1	--	*	--	--	--	--	*	
Arenac	1	1	--	*	--	--	--	--	*	
Benzie	7	4	--	*	--	--	--	--	3	
Cheboygan	14	8	*	2	--	3	*	--	1	
Clare	26	14	--	3	--	3	--	--	6	
Crawford	31	5	*	*	*	20	*	--	6	
Emmet	*	--	--	--	--	--	--	--	*	
Gladwin	7	2	--	1	--	2	--	--	2	
Grand Traverse	18	11	--	*	--	2	--	--	5	
Iosco	23	2	--	*	--	19	--	--	2	
Isabella	4	3	--	--	--	*	--	--	1	
Kalkaska	13	6	*	1	*	5	*	--	1	
Lake	49	13	--	1	*	11	--	--	24	
Leelanau	3	3	--	*	--	*	--	--	*	
Manistee	31	11	--	*	*	1	--	--	19	
Mason	21	7	--	*	--	4	--	--	10	
Mecosta	25	23	--	*	--	1	--	--	1	
Midland	7	7	--	*	--	--	--	--	*	
Missaukee	10	7	--	*	--	1	--	--	2	
Montmorency	31	17	*	2	--	7	*	--	5	
Newaygo	24	10	--	*	--	5	--	--	9	
Oceana	7	2	--	*	--	2	--	--	3	
Ogemaw	18	9	*	1	--	5	*	--	3	
Osceola	23	16	--	1	--	1	--	--	5	
Oscoda	59	20	*	3	--	32	*	--	4	
Otsego	3	*	*	*	--	2	*	--	1	
Presque Isle	21	12	*	4	--	3	*	--	2	
Roscommon	30	18	*	2	*	2	*	--	8	
Wexford	34	16	--	1	*	12	--	--	5	
Total	615	288	*	27	*	145	*	--	143	12

(Continued on next page)

(Table 12 continued)

MICHIGAN (continued)

Unit and county 1/	All species	Aspen	Balsam	Birch	Hem-lock	Pine	Spruce	Tam-arack	Misc. hdwd.	[illegible]
S. 1/2 LOW. PEN.:										
Allegan	*	*	--	--	--	*	--	--	[illegible]	
Barry	*	--	--	--	--	--	--	--	*	
Cass	1	--	--	--	--	1	--	--	--	
Gratiot	1	1	--	--	--	--	--	--	[illegible]	
Ionia	*	*	--	--	--	--	--	--	--	
Kent	*	*	--	--	--	*	--	--	*	
Lenawee	*	--	--	--	--	--	--	--	[illegible]	
Montcalm	9	3	--	--	--	*	--	--	[illegible]	
Muskegon	3	*	--	--	--	3	--	--	*	
Ottawa	*	*	--	--	--	*	--	--	[illegible]	
St. Joseph	*	*	--	--	--	--	--	--	*	
Van Buren	1	--	--	--	--	--	--	--	1	
Total	55	4	--	--	--	4	--	[illegible]	7	40
State total	1,406	596	66	33	69	240	51	[illegible]	196	152

1/ Includes only those counties that supplied pulpwood in 1970.
2/ County figures are not available.
* Less than 500 cords.

(Continued on next page)

(Table 12 continued)

MINNESOTA

Unit and county 1/	All species	Aspen	Balsam	Birch	Pine	Spruce	Tam-arack	Misc. hdwds.	Residues 2/
NORTHEASTERN:									
Carlton	26	22	1	1	1	1	*	--	
Cook	37	1	1	--	7	28	--	--	
Lake	66	22	*	1	30	13	*	--	
Pine	12	7	*	1	1	*	--	3	
St. Louis	299	156	7	14	84	22	5	11	
Total	452	208	9	17	123	64	5	14	12
CENTRAL PINE:									
Aitkin	49	34	3	2	1	2	6	1	
Becker	3	2	*	*	*	*	1	--	
Beltrami	77	46	8	1	12	6	3	1	
Cass	44	28	1	2	10	1	1	1	
Clearwater	50	39	*	*	5	2	4	*	
Crow Wing	11	3	--	1	7	--	--	--	
Hubbard	33	19	*	1	11	1	1	*	
Itasca	130	74	10	4	16	19	7	*	
Wadena	11	4	--	1	6	--	--	--	
Total	436	249	22	12	68	31	23	3	28
RAINY RIVER:									
Koochiching	227	125	14	2	14	58	5	9	
Lake of the Woods	36	2	*	*	5	27	2	--	
Total	268	127	14	2	19	85	7	9	5
HARDWOOD:									
Mille Lacs	6	5	*	--	--	*	--	1	
Morrison	7	6	*	--	1	*	--	--	
Ottertail	--	--	--	--	--	--	--	--	
Rice	*	--	--	--	*	--	--	--	
Scott	*	--	*	--	--	--	--	--	
Todd	*	--	--	--	*	--	--	--	
Total	51	11	*	--	1	*	--	1	38
PRAIRIE:									
Mahnomen	3	3	--	--	--	--	*	--	
Pennington	--	--	--	--	--	--	--	--	
Polk	1	--	--	--	--	--	1	--	
Roseau	13	2	--	*	10	1	*	--	
Total	17	5	--	*	10	1	1	--	--
State total	1,224	600	45	31	221	181	36	27	83

1/ Includes only those counties that supplied pulpwood in 1970.
2/ County figures are not available.
* Less than 500 cords.

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RECENT REPORTS ON PULPWOOD PRODUCTION PUBLISHED BY THE NORTH CENTRAL FOREST EXPERIMENT STATION

Pulpwood production in Lake States Counties, by Arthur G. Horn:

1960 data: Station Paper 94, 28 p.
1961 data: Station Paper 106, 18 p.
1962 data: Research Paper LS-5, 16 p.
1963 data: Resource Bulletin LS-1, 17 p.
1964 data: Resource Bulletin LS-2, 19 p.

Pulpwood Production in the North Central Region by County, by James E. Blyth:

1965 data: Resource Bulletin NC-2, 24 p.
1966 data: Resource Bulletin NC-3, 27 p.
1967 data: Resource Bulletin NC-6, 23 p.
1968 data: Resource Bulletin NC-8, 22 p.
1969 data: Resource Bulletin NC-11, 23 p.

Brief Notes for the past 10 years are:

1960: Tech. Note 606
1961: Tech. Note 624
1962: Research Note LS-23
1963: Research Note LS-48
1964: Research Note LS-65
1965: Research Note NC-3
1966: Research Note NC-31
1967: Research Note NC-59
1968: Research Note NC-86
1969: Research Note NC-100
1970: Research Note NC-126

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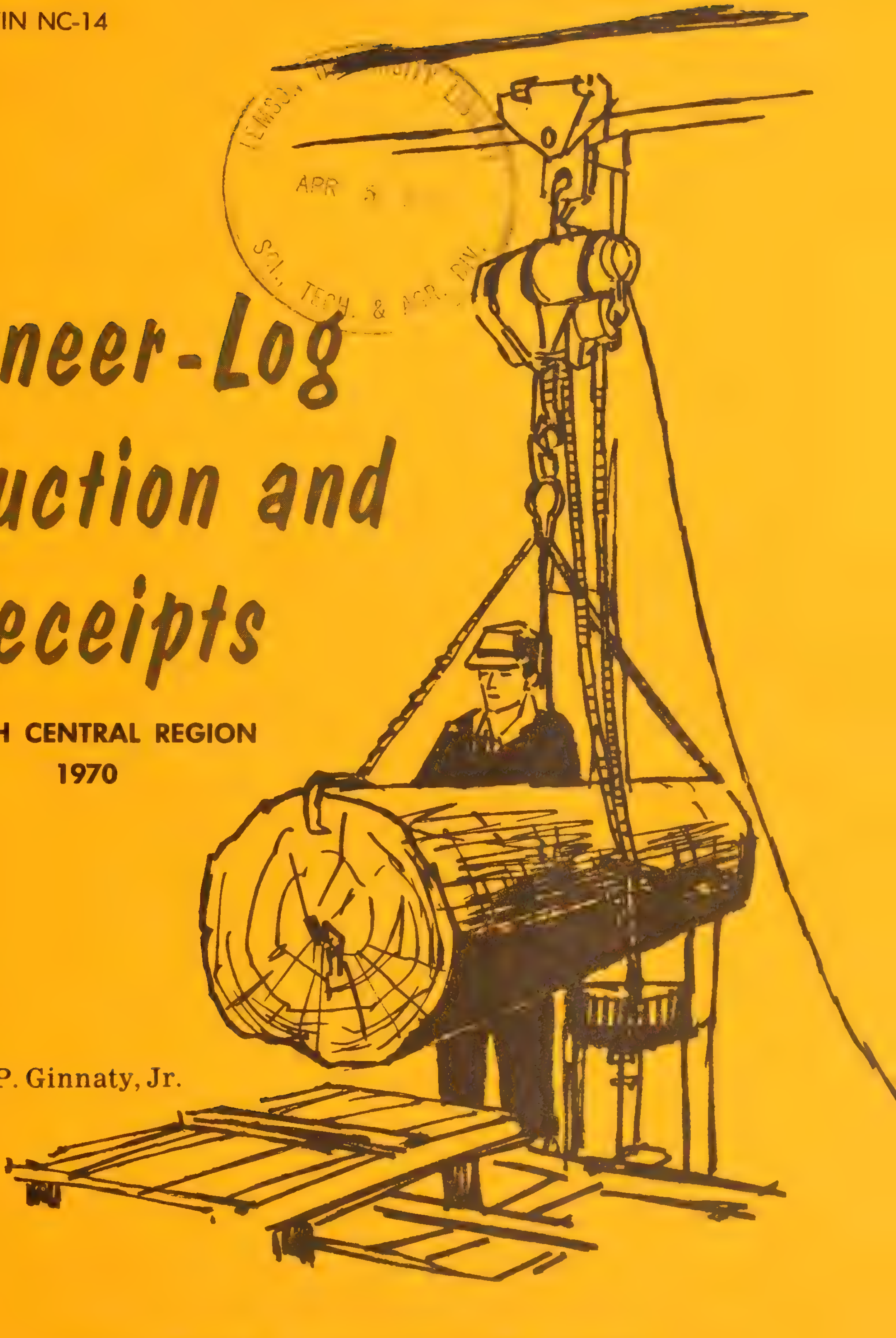
Veneer-Log Production and Receipts

NORTH CENTRAL REGION
1970



Thomas P. Ginnaty, Jr.

NORTH CENTRAL FOREST EXPERIMENT STATION
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U.S. DEPARTMENT OF AGRICULTURE

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VENEER-LOG PRODUCTION AND RECEIPTS, NORTH CENTRAL REGION, 1970

Thomas P. Ginnaty, Jr.

This report of 1970 veneer-log production[1] and receipts in the north central region is divided into two sections – Lake States (Minnesota, Wisconsin, and Michigan) and Central States (Indiana, Illinois, Iowa and Missouri) – because different species are grown and used as veneer logs in each area. In the Lake States, hard maple, elm, basswood, red oak, and yellow birch dominate; in the Central States, the hickories, oaks, and black walnut are more common.

Cooperation from the 43 standard[2] and 22 container[3] veneer mills in the region made this report possible (fig. 1). All but two mills reported their 1970 receipts by species and State of origin. Receipts were estimated for the nonresponding mills. Two mills are not included in this report to avoid disclosure of their operations (table 1). One of these mills is new and the other has never been included in previous reports. Export data are not reported except those to Canada.

Six container mills have closed since the 1968 veneer log production and receipts report.[4] Two other container mills shifted to standard veneer products. Two standard veneer mills have closed since 1968. Curtailing of mill operations in 1970 was common.

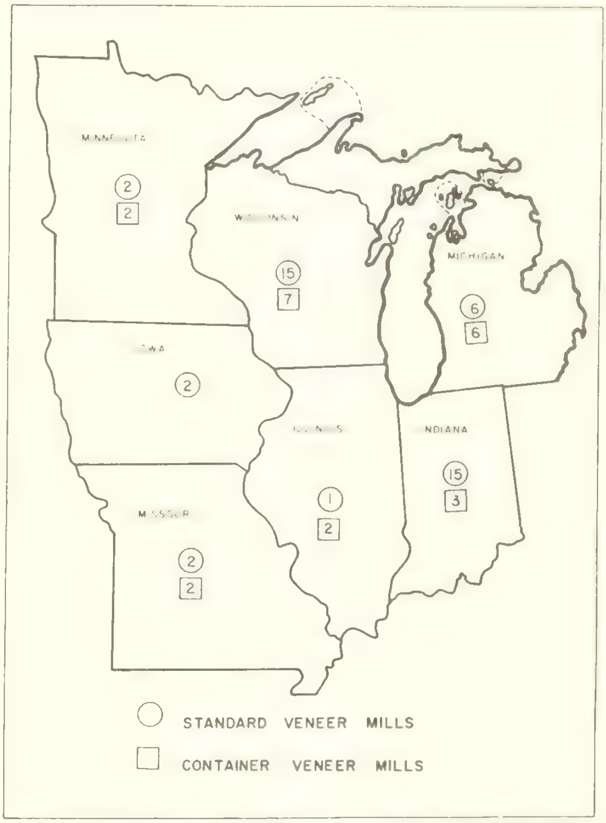

Figure 1.—Distribution of active veneer mills in the North Central States by State and type of mill, 1970.

LAKE STATES

Total veneer-log production declined between 1948 and 1958, and then leveled off for a few years until 1965. Since 1965 the trend has again been downward (fig. 2). The first decline probably can be attributed to substitute materials

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[1] *Production is the volume of veneer logs cut from a specific area; receipts are the volume of veneer logs received by mills in a specific area regardless of geographic source.*

[2] *Commercial, face, and specialty veneer mills that manufacture veneer used in doorskins, furniture, wall panels, specialty plywood, and similar items.*

[3] *Mills that manufacture veneers used in boxes, baskets, crates, packing cases and other wood-veneer containers.*

[4] *Thomas P. Ginnaty, Jr. Veneer-log production and receipts, north central region, 1968. USDA Forest Serv. Resource Bull. NC-10, 8 p., illus. N. Cent. Forest Exp. Sta., St. Paul, Minn. 1970.*

Table 1.—Active veneer mills in the North Central States by state and type of mill, 1970

Type of mill	Name of mill	Location
	MINNESOTA	
Standard	Diamond National Co.[1/]	Cloquet
	Wahkon Veneer Mills	Wahkon
Container	Bren Berry Box Mfg. Co.	Hopkins
	Elk River Box Co.	Elk River
	WISCONSIN	
Standard	Birchwood Lumber & Veneer Co.	Birchwood
	Birchwood Mfg. Co.	Rice Lake
	Calumet & Hecla, Inc.	Goodman
	Calumet & Hecla, Inc.	Mellen
	Eggers Plywood Co.	Two Rivers
	General Plywood Corp.	Antigo
	Gillette Veneer & Plywood Co.	Gillett
	Hatley Veneer Co., Inc.	Hatley
	Larson Plywood Co., Inc.	Sheboygan
	Linwood, Inc.	Gillett
	Marion Plywood Corp.	Marion
	U.S. Plywood Corp.	Algoma
	Weber Veneer & Plywood Co.	Showano
	Weyerhaeuser Co.	Marshfield
	Wisconsin Timber & Land Co.	Mattoon
Container	Brunette Box & Veneer Co.	Rice Lake
	Dufeck Mfg. Co.	Denmark
	Ebner Box Factory	Cameron
	Konz Container Co.	Howard Grove
	Seymour Woodenware Co.	Seymour
	Standard Container Co.	Edgar
	Wauzeka Box Co.	Wauzeka
	MICHIGAN	
Standard	Anthony & Co.	Escanaba
	Birdseye Veneer & Plywood Co.	Escanaba
	Iron Wood Products[1/]	Bessemer
	Manthei Bros.	Petoskey
	Plycoma Veneer Co.	Nashville
	Soo Veneer Co.	Sault Ste. Marie
Container	A. C. Hensel Mfg. Co.	Augusta
	American Made Veneer	Kalkaska
	Nelson R. Anderson Co.	Stevensville
	Fruit Growers Package Co.	Paw Paw
	Michigan Crate & Basket	Shelby
	Riverside Package Co.	Riverside
	IOWA	
Standard	R. S. Bacon Veneer Co.	Dubuque
	Spencer Hardwood Lumber Co.	Spencer
	MISSOURI	
Standard	Enterprise Veneer Corp.	Pleasant Hill
	Missouri Valley Walnut Co.	St. Joseph
Container	Betz Tipton Veneer Co.	Caruthersville
	Crumbliss Wood Products	Neosho
	ILLINOIS	
Standard	Swords Veneer & Lumber Co.	Rock Island
Container	Cobden Box & Basket Co.	Cobden
	Main Brothers Box & Lbr. Co.	Karnak
	INDIANA	
Standard	Amos-Thompson Corp.	Edinburg
	B. L. Curry & Sons	New Albany
	Central Veneer, Inc.	Indianapolis
	Chester B. Stem, Inc.	New Albany
	Curry Miller Veneers, Inc.	Indianapolis
	David R. Webb, Co.	Edinburg
	Evansville Veneer Co.	Evansville
	Hill Bros. Veneer Co., Inc.	Edinburg
	Hoosier Veneer Co., Inc.	Indianapolis
	Jasper Veneer Mills	Jasper
	Mitchell Industries	Greensburg
	National Veneer & Lumber Co.	Seymour
	Pierson-Holowell Co., Inc.	Lawrenceburg
	Roberts & Strack Veneer Co.	Clarksville
	Theising Veneer Co., Inc.	Mooresville
Container	Farrel Box Co., Inc.	Decker
	New Albany Box & Basket Co.,Inc.	New Albany
	W. C. Redmon Sons, Inc.	Peru

1/ Receipts not recorded to avoid disclosure of operations of this mill.

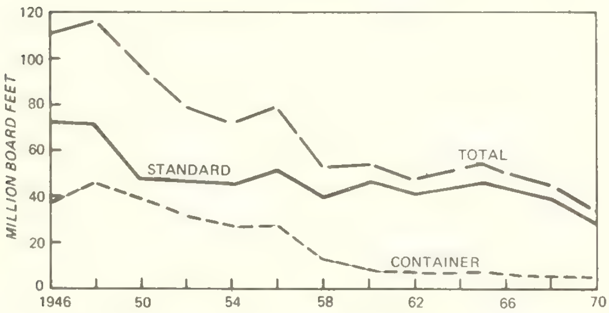

Figure 2.—Veneer-log production by year and type of industry, Lake States, 1946-1970.

capturing the traditional markets of the container veneer industry. Container veneer-log production leveled off in 1960 and remained stable through 1970, possibly because the mills are near the raw material source and suitable markets. This stabilization, coupled with a relatively steady standard veneer-log production, caused a firming of total veneer-log production between 1958 and 1965. A downward trend began in 1966, largely due to a reduction in thickness of veneer cut. This decline continued until by 1970 standard and total veneer-log production had decreased by a third as compared with 1965 production. The reasons for the decline most mentioned by the mill operators were the introduction of the print process[5] and increased foreign competition.

Comparison of veneer-log production and receipts figures from 1946 to 1970 shows that the Lake States veneer industry is depending less on outside log sources and procures most of its logs within the three Lake States.

Production

Loggers harvested 34.4 million board feet[6] of veneer logs in 1970, only 75 percent of the 1968 production. Most of the volume (29.4 million board feet) was cut for manufacture into standard veneer. Hard maple, red oak, and yellow birch were the principal species. The remainder, largely cottonwood and elm, were logged for manufacturing container veneer[7] (table 2).

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[5] *A manufacturing process that "prints" simulated natural wood finish on plastic, vinyl, hardboard, or nonfigured plywood panels.*

[6] *International ¼-inch log rule.*

Table 2.—Container veneer-log and bolt production and receipts by species and State, Lake States, 1970

(Thousand board feet, International ¼-inch rule)

Species and destination	Production			Mill Receipts
	Minnesota	Wisconsin	Michigan	
Cottonwood:				
Minnesota	(1/)	-	--	(1/)
Wisconsin	315	101	--	416
Michigan	--	--	499	499
Total	315	101	499	915
Elm:				
Minnesota	(1/)	--	--	(1/)
Wisconsin	525	1,300	--	1,825
Michigan	--	--	602	602
Total	525	1,300	602	2,427
Other hardwoods:				
Minnesota	(1/)	--	--	(1/)
Wisconsin	31	256	--	287
Michigan	--	--	1,156	1,156
Total	31	256	1,156	1,443
All species:				
Minnesota	(1/)	--		(1/)
Wisconsin	871	1,657	--	2,528
Michigan	--	--	2,257	2,257
Total	871	1,657	2,257	4,785

1/ Not included to avoid disclosure of individual mill operations.

Wisconsin produced 15.8 million board feet of veneer logs in 1970, a 25 percent decrease since 1968 (table 3). Red oak and hard maple accounted for 33 and 20 percent, respectively, of the total production. Wisconsin mills consumed more than 90 percent of the volume produced within the State and three-fourths of the total volume produced in the Lake States.

Michigan harvested 15.0 million board feet of veneer logs. Hard maple and yellow birch (36 and 25 percent of the total) were the predominant species. Michigan exported about two-thirds of the volume produced, 49 percent of the total production going to Wisconsin mills.

Minnesota harvested 3.5 million board feet, one-tenth of the Lake States total. Eighty-four percent of the Minnesota production was exported to Wisconsin. The major species produced were elm, cottonwood, basswood, and red oak.

The Lake States exported 3.0 million board feet of veneer logs in 1970 (52 percent less than in 1968). Indiana mills received two-thirds of this volume. Michigan supplied three-fourths of the total volume exported. The major species exported was hard maple.

Mill Receipts

Lake States mills received 37.0 million board feet of veneer logs in 1970, a decline of 10.6 million board feet since 1968 and 18.4 million board feet since 1966.

Hard maple log receipts showed only a slight increase since 1968 due to the end-use versatility of this species (fig. 3). Yellow birch purchases fell significantly, reflecting competition from imports and a decline in the use of this wood in cabinetmaking. Lower receipts of red oak, used mainly for paneling and doors, reflected a drop in these markets. Elm showed a substantial overall loss in 1970 due to the slackening demand by standard veneer mills for this species, although there was an increase in its use in the container industry. Elm supplies in the woods have been much reduced by disease in recent years.

Wisconsin received 30.0 million board feet of veneer logs in 1970, down from 37.6 million board feet in 1968. More than half the volume was hard maple and red oak. More than 50 percent of the logs came from within the State; Michigan supplied 7.3 million board feet (mainly hard maple and yellow birch), and Minnesota supplied 3.0 million board feet (mainly elm, red oak, and cottonwoods). Fifteen percent of the wood used in Wisconsin was imported from outside the Lake States, three-fifths of which came from Canada (mainly hard maple and yellow birch).

---

[7] *An additional 1,645 cords of heading stock were cut for the container mills.*

Table 3.—Production and imports of veneer logs, Lake States, 1970

(Thousand board feet, International ¼-inch rule)

Species and Destination	Production (Volume of veneer logs cut in each State)				Imports			Lake States receipts[1]
	Minnesota	Wisconsin	Michigan	Region total	Other States	Canada	Total imports	
Aspen								
Minnesota	17	--	--	17	--	--	--	17
Wisconsin	19	1,155	2	1,176	--	--	--	1,176
Michigan	--	--	79	79	--	--	--	79
Outside Lake States	--	--	--	--	--	--	--	--
Total	36	1,155	81	1,272	--	--	--	1,272
Ash								
Minnesota	17	--	--	17	--	--	--	17
Wisconsin	21	164	15	200	10	--	10	210
Michigan	--	--	127	127	--	--	--	127
Outside Lake States	--	--	6	6	--	--	--	--
Total	38	164	148	350	10	--	10	354
Basswood								
Minnesota	93	--	--	93	--	--	--	93
Wisconsin	443	2,026	224	2,693	322	--	322	3,015
Michigan	--	--	462	462	--	--	--	462
Outside Lake States	--	--	20	20	--	--	--	--
Total	536	2,026	706	3,268	322	--	322	3,570
Beech								
Wisconsin	--	6	23	29	--	--	--	29
Michigan	--	--	264	264	--	--	--	264
Total	--	6	287	293	--	--	--	293
White birch								
Minnesota	13	--	--	13	--	--	--	13
Wisconsin	145	159	137	441	7	398	405	846
Michigan	77	--	630	707	--	361	361	1,068
Outside Lake States	--	--	--	--	--	--	--	--
Total	235	159	767	1,161	7	759	766	1,927
Yellow birch								
Wisconsin	131	536	2,351	3,018	--	1,133	1,133	4,151
Michigan	--	26	1,386	1,412	--	567	567	1,979
Outside Lake States	--	--	36	36	--	--	--	--
Total	131	562	3,773	4,466	--	1,700	1,700	6,130
Butternut								
Wisconsin	--	3	--	3	--	--	--	3
Michigan	--	3	2	5	--	--	--	5
Outside Lake States	44	277	--	321	--	--	--	--
Total	44	283	2	329	--	--	--	8
Black cherry								
Wisconsin	2	28	6	36	1	--	1	37
Michigan	--	--	31	31	--	--	--	31
Outside Lake States	--	5	29	34	--	--	--	--
Total	2	33	66	101	1	--	1	68
Cottonwood								
Minnesota	85	--	--	85	--	--	--	85
Wisconsin	591	126	--	717	97	--	97	814
Michigan	--	--	499	499	--	--	--	499
Outside Lake States	--	--	--	--	--	--	--	--
Total	676	126	499	1,301	97	--	97	1,398

(Continued on next page)

Table 3 continued

Species and Destination	Production (Volume of veneer logs cut in each State)				Imports			Lake States receipts 1/
	Minnesota	Wisconsin	Michigan	Region total	Other States	Canada	Total imports	
Elm								
Minnesota	40	--	--	40	--	--	--	40
Wisconsin	893	1,880	126	2,899	46	--	46	2,945
Michigan	--	30	772	802	33	--	33	835
Outside Lake States	34	--	--	34	--	--	--	
Total	967	1,910	898	3,775	79	--	79	3,820
Hickory								
Michigan	--	--	6	6	148	--	148	154
Outside Lake States	--	--	15	15	--	--	--	--
Total	--	--	21	21	148	--	148	154
Sugar and black maple								
Minnesota	43	11	11	65	--	-	--	65
Wisconsin	120	3,195	3,576	6,891	287	1,040	1,327	8,218
Michigan	--	--	724	724	--	--	--	724
Outside Lake States	25	--	1,077	1,102	--	--	--	--
Total	188	3,206	5,388	8,782	287	1,040	1,327	9,007
Red and silver maple								
Minnesota	27	--	--	27	32	--	32	59
Wisconsin	71	506	119	696	52	--	52	748
Michigan	--	--	104	104	--	--	--	104
Outside Lake States	--	--	--	--	--	--	--	--
Total	98	506	223	827	84	--	84	911
Red oak								
Minnesota	1	--	--	1	--	--	--	1
Wisconsin	501	5,214	766	6,481	924	132	1,056	7,537
Michigan	--	11	76	87	25	--	25	112
Outside Lake States	--	11	250	261	--	--	--	--
Total	502	5,236	1,092	6,830	949	132	1,081	7,650
White oak								
Wisconsin	5	134	--	139	--	--	--	139
Michigan	--	9	34	43	15	--	15	58
Outside Lake States	--	--	108	108	--	--	--	--
Total	5	143	142	290	15	--	15	197
Walnut								
Michigan	--	--	--	--	-	--	--	--
Outside Lake States	31	283	245	559	--	--	--	--
Total	31	283	245	559	--	--	--	--
Misc. species								
Wisconsin	9	16	2	27	1	--	1	28
Michigan	--	--	203	203	25	--	25	228
Outside Lake States	--	--	496	496	--	--	--	--
Total	9	16	701	726	26	--	26	256
All species								
Minnesota	336	11	11	358	32	-	32	390
Wisconsin	2,951	15,148	7,347	25,446	1,747	2,703	4,450	29,896
Michigan	77	79	5,399	5,555	246	928	1,174	6,729
Outside Lake States	134	576	2,282	2,992	--	--	--	--
Total	3,498	15,814	15,039	34,351	2,025	3,631	5,656	37,015

1/ Production minus exports plus imports.

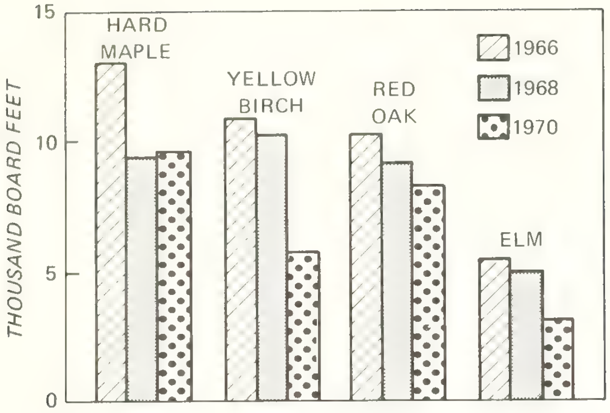

Figure 3.—Veneer-log receipts in Lake States by major species.

Michigan received 6.7 million board feet of veneer logs, of which 80 percent came from within the State. Yellow birch and paper birch were the predominant species.

Table 4.—Disposition of primary plant residue by type and by volume of mill receipts, Lake States, 1970

(In percent)

Use	Residue		
	Bark	Veneer cores	Veneer clipping
Manufacture of pulp, hardboard, or roofing felt:	--	19	9
Industrial fuel:	87	60	77
Domestic fuel:	(1/)	1	--
Small dimension or specialty items:	--	16	(1/)
Not used:	13	4	14
Total	100	100	100

1/ Less than 0.5 percent

Minnesota's mills procured 0.4 million board feet of veneer logs. One Minnesota mill changed from producing container veneer to standard veneer (table 1).

Mill Residues

The residues of veneer mills in the Lake States, such as bark, veneer cores, and veneer clippings, were largely used as commercial or domestic fuels. However, 38 percent of the volume of veneer cores was used in the manufacture of fiber products such as pulp, hardboard, and roofing felt (table 4).

CENTRAL STATES

Production

Veneer-log production dropped to 23.5 million board feet in 1970 from 37.0 million board feet in 1968 (table 5). Although this 36 percent reduction was not uniform in each State, production in every State declined, Iowa and Missouri were affected most, possibly because of the relatively long distance to receiving mills. During slack market periods, veneer mills tend to purchase their logs nearer the mill.

Walnut and cottonwood accounted for 35 and 20 percent of the 1970 veneer-log production, respectively. Walnut, hickory, white and red oak harvests all showed a sharp drop from 1968, probably due to the increasing popularity of synthetic prints, changing furniture styles, and foreign competition. Cottonwood, sycamore, and soft maple were the species used primarily by the container veneer industry (table 6).

Mill Receipts

Mill receipts in the Central States were 28.0 million board feet in 1970, a 43 percent reduction from 1968 (fig. 4). All major species were affected. The mill operators cited foreign competition and increased use of plastic and vinyl prints in the production of panels and furniture as the reasons for this reduction.

Mill Residues

Veneer mill residues were used largely for industrial fuel (table 7). Nine percent of the fine residues (veneer clippings) and 19 percent of the course residues (veneer cores) were used in manufacture of fiber products. Sixteen percent of the veneer cores were used in small dimension or specialty items.

Table 5.—Production and imports of veneer logs, Central States, 1970

(Thousand board feet, International ¼-inch rule)

Species	Destination	Production					Imports			Central States receipts[1]
		Indiana	Illinois	Iowa	Missouri	Production total	Other States	Canada	Total imports	
Ash	Indiana	174	[illegible]	--	--	[illegible]	151	--	151	331
	Other Central States[2]	--	--	75	22	97	6	--	[illegible]	103
	Outside Central States	[illegible]	--	1	6	19	--		--	--
	Total	177	[illegible]	85	28	296	157	--	157	[illegible]
Basswood	Indiana	--		-		[illegible]	20	--	[illegible]	[illegible]
	Other Central States[2]	--				5	-	--	--	5
	Outside Central States	--	21	296	-	317	--	--	--	--
	Total	--	21	301	--	[illegible]	20	--	20	25
Black cherry	Indiana	57	--	--	--	57	132	--	[illegible]	189
	Other Central States[2]	--	-	1	--	1			--	1
	Outside Central States	19	--	[illegible]	--	20	--	--	--	--
	Total	76	--	2	--	78	132	--	132	190
Butternut	Indiana	7	3	66	3	79	324	--	324	[illegible]
	Other Central States[2]	-	--	49	--	[illegible]	--	--	-	49
	Outside Central States		-		--	--	-	--		-
	Total	7	3	115	3	128	324		324	452
Cottonwood	Indiana	1,118		--	--	1,118	104	--	104	1,222
	Other Central States[2]	122	[illegible]	--	705	2,511	1,016	-	1,016	3,527
	Outside Central States	--	--	1,121	--	1,121	--	--	--	--
	Total	1,240	[illegible]	1,121	705	4,750	1,120	--	1,120	4,749
Elm	Indiana	51		--	--	51	5	--		56
	Other Central States[2]	-	-	398	22	420	-	--		420
	Outside Central States	--	--	85	--	85			--	--
	Total	51	--	483	22	556	5	--	5	476
[illegible]	Indiana	458	[illegible]	--	--	501	117	-	117	618
	Other Central States[2]	8	121	--	37	166	47	--	47	213
	Outside Central States		--	--	--	2	--			
	Total	466	164	--	39	[illegible]	164	--	164	831
[illegible]	Indiana	[illegible]	115	--	33	287	1,622	--	1,622	1,909
	Other Central States[2]	--	103	361	468	932	153	-	153	1,085
	Outside Central States	[illegible]	20	-	128	297	--	--	--	--
	Total	288	238	361	629	1,516	1,775	--	1,775	[illegible]
Sugar and black maple	Indiana	309	18	--	--	327	938	66	1,004	1,331
	Other Central States[2]	--	-	--	--	--	-		-	
	Outside Central States	[illegible]	3	292	--	[illegible]	--	--	--	--
	Total	483	21	[illegible]	--	796	938	66	1,004	1,331
Red and silver maple	Indiana	130				[illegible]	11	--	11	141
	Other Central States[2]	22	180	13	116	331	140	--	140	471
	Outside Central States	--	--	84	5	89	--	--		--
	Total	152	180	97	121	[illegible]	151	--	151	612
Red oak	Indiana	92	13	--	-	105	257	-	257	362
	Other Central States[2]	[illegible]	53	333	39	432	47	-	47	[illegible]
	Outside Central States	25	120	597	--	742	--	--		
	Total	124	186	[illegible]	39	1,279	304	-	[illegible]	841
White oak	Indiana	1,206	172	--	19	[illegible]	567	--	[illegible]	1,964
	Other Central States[2]	--	-	--	1	1	--	--	--	1
	Outside Central States	255	--	--	10	265		--	--	--
	Total	1,461	172		30	1,663	567	-	567	1,965
Sycamore	Indiana	1,049	-	-	--	1,049	52		52	1,101
	Other Central States[2]	7	142	--	62	211	50	--	50	261
	Outside Central States	--	--	--	42	42	--		--	
	Total	[illegible]	142	--	104	1,302	102	--	[illegible]	1,362
Yellow poplar	Indiana	780	--	--	--	780	249	--	249	1,029
	Other Central States[2]	--	22	-	4	26	-	--	--	26
	Outside Central States	--	--	1	42	43	--	--		
	Total	780	22	1	[illegible]	[illegible]	249	--	249	1,055
Walnut	Indiana	3,762	[illegible]	380	713	[illegible]	1,912	--	1,912	8,310
	Other Central States[2]	--	299	405	499	1,203	465	--	[illegible]	1,668
	Outside Central States	532	--		[illegible]	538	--	--	--	--
	Total	[illegible]	1,842	785	1,218	[illegible]	2,377	--	2,377	9,978
Misc. species	Indiana	609	--	--	-	609	24	--	24	633
	Other Central States[2]	--	--	14	--	14	14	--	14	28
	Outside Central States	--	--	7	11	18	--	--	--	-
	Total	609	--	21	11	641	38	--	38	661
All species	Indiana	[illegible]	1,913	446	768	13,068	6,485	[illegible]	6,551	19,619
	Other Central States[2]	166	2,604	1,654	1,975	[illegible]	1,938	--	1,938	8,337
	Outside Central States	1,157	164	2,494	252	4,067	--	--	--	--
	Total	11,264	4,681	[illegible]	2,995	[illegible]	8,423	[illegible]	8,489	27,956

[1] Production minus exports plus imports

[2] Illinois, Iowa and Missouri

Table 6.—Production and imports of container veneer logs, Central States, 1970

(Thousand board feet, International ¼-inch rule)

Species and destination	Production					Imports			Central States receipts[1]
	Indiana	Illinois	Iowa	Missouri	Region total	Other states	Canada	Total	
Cottonwood:									
Indiana	1,042	--	--	--	1,042	104	--	104	1,146
Other Central States[2]	122	1,684	--	705	2,511	1,016	--	1,016	3,527
Outside Central States	--	--	1,035	--	1,035	--	--	--	--
Total	1,164	1,684	1,035	705	4,588	1,120	--	1,120	4,673
Red and silver maple:									
Indiana	31	--	--	--	31	11	--	11	42
Other Central States[2]	22	180	--	116	318	140	—	140	458
Outside Central States	--	--	--	--	--	--	--	--	--
Total	53	180	--	116	349	151	--	151	500
Sycamore:									
Indiana	907	--	--	--	907	52	--	52	959
Other Central States[2]	7	142	--	62	211	48	--	48	259
Outside Central States	--	--	--	--	--	--	--	--	--
Total	914	142	--	62	1,118	100	--	100	1,218
Other hardwoods:									
Indiana	244	--	--	--	244	41	--	41	285
Other Central States[2]	15	196	--	124	335	100	--	100	435
Outside Central States	--	--	--	--	--	--	--	--	--
Total	259	196	--	124	579	141	--	141	720
All species:									
Indiana	2,224	--	--	--	2,224	208	--	208	2,432
Other Central States[2]	166	2,202	--	1,007	3,375	1,304	--	1,304	4,679
Outside Central States	--	--	1,035	--	1,035	--	--	--	--
Total	2,390	2,202	1,035	1,007	6,634	1,512	--	1,512	7,111

[1] Production minus exports plus imports

[2] Illinois, Iowa and Missouri

Figure 4.—Veneer-log production and mill receipts in Central States, 1956-1970.

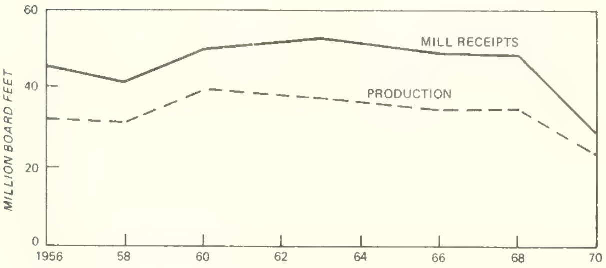

Table 7.—Disposition of primary plant residue by type and use, Central States, 1970

(In percent)

Use	Residue		
	Bark	Veneer cores	Veneer clipping
Manufacture of pulp, hardboard, or roofing felt:	--	38	5
Charcoal or chemical wood:	--	(1/)	--
Industrial fuel:	88	32	91
Domestic fuel:	--	23	--
Small dimension or specialty items:	--	4	(1/)
Not used:	12	3	4
Total	100	100	100

1/ Less than 0.5 percent

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